The Builder.

VOL. LXIII. No. 2583. AUGUST 6, 1892.

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Later Scotch Castles.

WE may congratulate Mr. MacGibbon and Mr. Ross on having completed their monumental work on Scotch castles,* which has gone on expanding under their hands till it has now swelled into five volumes. Possibly the fifth volume is not exactly a necessary part of the scheme, and is filled up in rather an *olla podrida* manner, though it is all interesting. The fourth volume continues the illustration of castles of what the authors have called the Fourth Period, and at the close branches out into the subject of "Houses in Towns," as influenced in their architecture by the castellated buildings; and continuing this subject into the fifth and unexpected volume, we have also some churches and a long illustrated chapter on sun-dials; and the book concludes with a summary of the information which the authors have been able to collect as to early Scottish masters of works, master masons, and architects. This information is of real interest, and the carrying out of the subject into a fifth volume has also given room for the addition of a long supplement in regard to smaller castles which had been omitted in their proper place, and information about which had come into the authors' hands since. This, of course, is a valuable addition, and renders the book more complete. We confess that the chapters on town houses and churches seem rather like padding, arising out of the fact that there was too much matter, in the real line of the book, for the fourth volume and not enough to make a good fifth one. The portions dealing with town houses and churches do not pretend to exhaust those subjects, but merely to give some interesting examples; and this is rather out of keeping with the complete style of the bulk of the book. It would have been better to have terminated the castles of the fourth period with the end of the fourth volume, and made a small fifth volume under the title of "appendix," giving the castles omitted before, and the information about ancient master-masons. The book would then have been a complete whole. As it is, the closing volume is weighted with matter which does not properly belong to the scheme of the work, and that is always an injury to a book, especially a book which is intended to take a permanent place as a leading illustrative work on the subject of which it treats.

The fourth period, of those into which the authors have divided their subject, and which is in process of continuation in their fourth volume, comprises the class of castles the design and plan of which were affected by the double influence of Renaissance taste and the introduction of fire-arms. The use of artillery naturally enough did away with the ancient *enceinte* wall, which could not be made artillery-proof except at a greater cost than the means of a private owner could supply. The castles were to be made defensible against sudden attack, and the walls were pierced for musketry in suitable places, and a form of plan was adopted which enabled one portion of the building to command another. There can be little doubt that this practical object was the main origin of the two most favourite and important forms of plan in the later Scotch castles, the L-plan and what the authors call for convenience the Z-plan, but which is really a plan in the shape ⌐. In the L-plan each of the inner sides commands the other; in the Z-plan, which is much more complete and scientific in a military sense, the projecting towers at opposite ends and sides of the main building each command one side of the building, which is thus defended both on the inner and outer side. It is hardly correct, however, to ascribe this form of planning directly, as the authors do (vol. iii. page 368), to the influence of fire-arms. It was the invention of artillery which removed the *enceinte* and drove the builders to recast the ancient keep on these new lines; but the perception that a projecting tower allows of flanking an attacking party up to the very walls of the main building would be equally to the purpose whether the weapons were muskets or cross-bows: it merely means an improved and more scientific perception of the art of defence. The authors are quite correct, however, in their remark, in the same place, on the peculiar combination which the late Scotch castles present of Renaissance architecture with castellated features of an older time, stern-looking corbelled-out turrets, &c. The French château presented something like this combination at an earlier period, but not with such a late style of Renaissance. It is this combination of late Renaissance detail with castellated detail which has survived from an earlier period, that gives to late Scotch castellated architecture its peculiar and unique character.

The majority of the castles of the late period illustrated in vol. iv. are rather small ones, illustrating the various types of plan which may be indicated by the letters L, Z, T, and E, of which, as already suggested, the two former are the most interesting and most numerous. The L-plan, with a large circular turret at the re-entering angle, is one of the most favourite arrangements, and is capable of very picturesque effect in an architectural sense. In later examples we return again in many instances to the courtyard plan, either as a complete quadrangle or a portion of one. The persistence or recurrence of certain central types of plan through all these changes is to be noted. The early castle was a keep within a courtyard, the latter being surrounded by buildings for defence only, not for habitation. In the seventeenth century we come to the courtyard plan again, but now it is the habitable building itself which surrounds the courtyard. So again, in the L and Z castles without courtyards; these are simply the keep deprived of its *enceinte*, and modified in form, from its original simple square or parallelogram, into a form capable of self-defence.

Holyrood and Heriot's Hospital, as important examples of the courtyard plan, are very fully illustrated, as the book could not be complete without them, but these well-known buildings are not of such special interest to readers as some of the smaller and little known examples, the illustrations of which afford a mine of suggestions for picturesque treatment. Among them we may mention especially Murthly Castle, with its façade flanked by circular angle turrets (in this

* "Castellated and Domestic Architecture of Scotland from the Twelfth to the Eighteenth Century." By David MacGibbon and Thomas Ross, architects. Volumes iv. and v. Edinburgh: David Douglas. 1892.

case rising from the ground and not on corbels), its simple treatment of doors and windows, and its two "corbie-stepped" gables connected at the base by a balustrade, a curious union of Scotch and Renaissance features. Thurso Castle, no longer existing in the form shown here, is another most characteristic example, looking like a long plain country house with sash windows, from the front of which project circular turrets with conical roofs. In Thirlstane Castle we have a much bolder example of the same kind of combination, the circular turrets in this case forming partial supports to a boldly projected machicolation, over which is a Renaissance balustrade with the roof and small dormers recessed behind it. This is one of the most picturesque illustrations in the book, and a very suggestive lesson as to the effect to be got by the combination of what at first sight might seem totally incongruous elements. Preston Lodge staircase, with its curiously attenuated baluster columns rising from the top of the lower newels to the underside of the upper ones, is interesting.

Although, as we have said, the portion dealing with houses in towns is rather out of the scope of the book, the preliminary sketch of the character of Scotch street architecture is of considerable interest, and conveys a good idea of what must have been the aspect of a street of the sixteenth century in a Scotch town, with its masonry walls as the substantial structure, and wooden galleries and verandahs thrust out in front of the walls. "It can be well imagined," as the authors observe, "what a picturesque aspect these galleries would present, and what an animated and brilliant appearance they must have had when filled with spectators, and decorated with rich hangings on occasions of public importance and display." Of the churches which are illustrated as exhibiting the architectural influence of the castellated architecture on this class of building in Scotland, a good many seem to us to be not much to the point in this respect, though they are all more or less interesting work; but the towers of Pittenweem and Anstruther Churches, with their combination of heavy turrets with corbelling, massed into ordinary square church-towers with balustrades over the eaves, are certainly curious and characteristic, and form such an architectural grouping as we could hardly expect to meet with anywhere but in Scotland.

Many illustrations are given of the peculiar forms which the sun-dial took in Scottish hands. These may be grouped under two heads; the obelisk form, with generally a large projection or swelling in the middle of its height (one of which many of our readers have probably inspected in the middle of the grand "formal garden" of Drummond Castle), and the other which the authors not unsuitably define as the "lectern" form, and which they suggest was really a transformation into stone of the "torquetum" of Apian (a professor of mathematics at Ingolstadt), one of which is represented in Holbein's "Ambassadors" picture, an instrument by which "the position of the sun, moon, and stars could be indicated at any hour." What is certain as to these dials is that in their stone form they must have been very useless, mere puzzles, and that they are very ugly. The English sun-dial is a beautiful object, which can be practically used for its purpose; the Scotch sun-dials seem rather like exhibitions of cleverness to very little purpose, and are entirely devoid of the sentiment of repose which belongs to the English type. The authors mention one form, at Scotscraig, in which a cross, placed to the required angle, forms the gnomon, the hours being read by the shadow of the head of the cross projected on the upper edge of the arms. We recently saw one of this type in England, set up in the garden of a Sussex rectory, but we cannot give its date or history.

The chapter on ancient Scotch masons and masters of works gives a great deal of curious information, and we have no doubt the authors are right in their conclusion that the Scottish architect, even in the later periods of castellated architecture, was not much in request (was he much in existence?), and that the various buildings were erected by masons under the laird's instructions, as Mr. Gotch maintains (perhaps with equal correctness) that the English Renaissance mansions were built. In the case of Glamis Castle "we have a very striking example of a structure carried out from the designs and under the personal superintendence of two successive proprietors, — Patrick, first earl of Kinghorn (1578—1615), and his grandson Patrick, the third earl (1647—95). The book of record of the latter shows how closely the work was designed and supervised by himself." It is noticeable, too, that Glamis is, *en bloc*, one of the most picturesque buildings of its class. How the details would bear inspection is another question.

We congratulate the authors on the completion of a very fine and valuable work, which every architectural library should possess. It seems to have excited a great deal of attention and interest in Scotland, for it is partially owing to the amount of additional information gratuitously furnished to them since the commencement of the undertaking, that the authors have been encouraged and enabled to extend it beyond its original limits, and render it a probably complete summary of the castellated dwellings of Scotland.

THE "GRAVENKASTEEL" OR "CHATEAU DES COMTES," GHENT.

By General Wauwermans, President of the Archæological Society of Antwerp.

THE origin of Ghent may be traced to a remote epoch. It is supposed that the first dwellings were erected upon some rising ground between the Scheldt and the Lys, known as Mont Blandin, where the inhabitants, doubtless, took refuge against the inundations which, even in our time, periodically submerge the left bank of the Lys and the right bank of the Scheldt towards Tronchiennes and Ledeberg. Numerous Roman remains testify to the fact that the town was already inhabited in the days of Nero (53 A.C.), perhaps, at an earlier date still, judging by the vestiges of a temple of Odin, the Mercury of the Germans, that was destroyed by the early Christians on Mount Blandin.

Ghent, originally called *Heerehem*, "the home of the lords," was probably a centre of maritime defence for the Romans, and served to protect the coasts of Flanders against the invasions of the pirates of the north. Traces may still be found of by-roads leading to Oudenburg, Bouchout, Antwerp, the mouth of the Scheldt, and Zeeland. Certain authors attribute to the Romans the cutting of the mysterious artificial waterway known as Otho's Ditch (le fosse d'Othou) which would appear to have been made in the time of Constantine Chlorus (290) to resist an invasion of the northern hordes. This canal placed the port of Ghent in communication with the Braekman, the Western Scheldt, and the Zwyn.*

In 620 St. Amand, who came to preach Christianity at Ghent, founded upon the site of Odin's temple the Abbey of St. Peter.† In 630 St. Bavon undertook the conversion of the barbarians north of the Scheldt, and founded the Abbey of St. Bavon,‡ around which a kind of floating population gathered itself. The group of buildings thus formed was called Ganda, or Gandavum, and gave its name to the whole agglomeration.

In 811 Charlemagne established dockyards at Ghent for the purpose of fighting the Normans. This fact confirms the hypothesis of the previous cutting of the canal of Otho, for without the existence of a double fluvial communication between Ghent and the sea, by means of the canal on the one hand and the Scheldt on the other, there could have been no motive for selecting it as a centre of maritime defence, which otherwise would have been better found by Charlemagne further down the River at Rupelmonde, a place that commands the mouth of nearly all the rivers of Western Belgium.

It is said that Eginhard, Charlmagne's secretary and son-in-law, was placed in authority over the two abbeys of St. Peter and St. Bavon, each retaining, however, a distinct dominium. The abbots of St. Peter held sway over the centre (*Keure*) and the post of *Heerehem*, while the abbots of St. Bavon continued to proselytise the Pagans of the Marches between the Schedlt and Otho's ditch, a district known as Wasda, or the land of woes.

The abbey of St. Peter depended upon the imperial diocese of Cambrai, while St. Bavon formed part of the diocese of Utrecht and held authority over the Marches of the German Empire.

In 852 Baldwyn Fercus (Bandouin bras-de-fer) and Regnier "au long col" defended Neustria and Lotharingia against the Normans.

The history of these two warriors presents the curious analogy that both had quarrelled with their chiefs on account of clandestine marriages with the daughters of the latter, and that both were reconciled to their irate father-in-law and confirmed by them, with their children after them, in their high functions. Baldwyn, who had married Judith, the daughter of Charles the Bald, became Marquis of the Flemings. Being declared the champion of the kingdom, he established a military frontier to the north of Flanders by constructing the castles of Bruges and of Ghent, and possibly at intermediate stations as well.

This was the origin of the old castle of Ghent placed beyond the Lys, and answering to the type of a frontier stronghold destined to act against the northern regions, while holding in check the turbulent population of *Heerehem* to the south and separated from the Wasda by the ditch of Otho.

The Castle of Baudouin bras-de-fer, restored by Arnould le Vieux, occupied by Wichmann, was reconstructed in 1180 by Philippe of Alsatia, Count of Flanders, upon his return from Syria, as set forth by a carved inscription upon the entrance of the gate. If it is not possible to fix the exact date of this reconstruction, it is at least certain that it offers the first example of a Mediæval stronghold showing the influence of the Syrian type brought back by the Crusaders, and that it was erected at least fifteen years earlier than the famous Château Gaillard des Andelys, built by Richard Cœur de Lion in 1196, and generally supposed to be the most ancient specimen of a Romano-Byzantine fortress in Europe.

The Château des Comtes was abandoned as a princely residence in 1353 by Count Louis le Mâle. He took up his abode in the more splendid palace known as the Cour des Princes, of which the ruins are also to be seen at Ghent. This was the birth-place of Charles V.

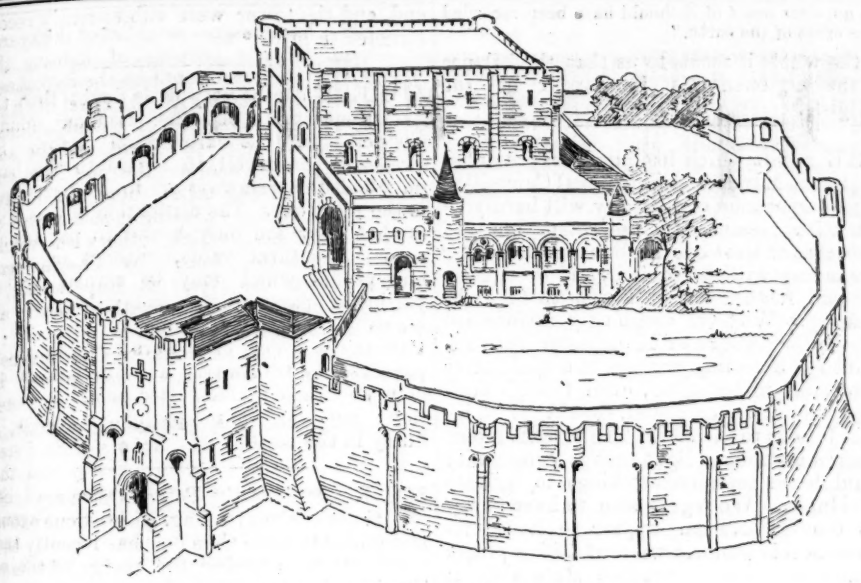
The ancient castle became a state prison, and sheltered behind its walls the unhappy Countess Jacqueline de Baviere. In 1419 it became the seat of the Council of Flanders, which had held its meetings hitherto at Lille. In 1779 it was divided into lots and sold at a public sale to a contractor called Brisemaille.

Thenceforth the Château des Comtes lay dismembered and forgotten behind factories, workshops, and labourers' dwellings, until the only trace that remained of it was the stone archway of the entrance, overlooking the Place Ste. Pharailde, that strangers looked up at curiously. In 1829 a cotton mill, belonging to M. Couvreur, being destroyed by

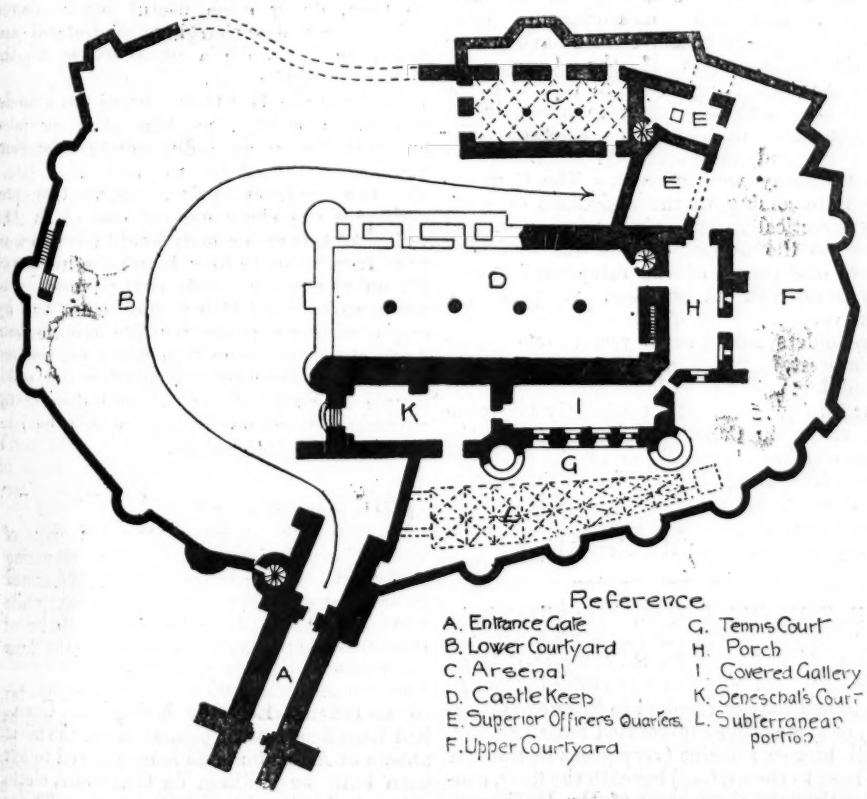
* Otho's ditch still exists in Ghent. It has been partly covered over and forms a street which runs before the University Library, formerly the Abbey of Bandeloo.

† St. Peter's Abbey, which commands the town of Ghent, is now used as a barrack. The church is well worth a visit.

‡ This abbey was transferred to the St. John's Church, now called Cathedral of St. Bavon, by Charles V., when he wanted to build a citadel on the spot where St. Bavon first established his monks. The ruins of the old abbey still remain near the Station du pays de Waes, and are most interesting. Their Roman origin is indisputable. They form now a museum.



Restored View of Château des Comtes, Ghent.



Plan of Château des Comtes, Ghent, showing the Existing and the Restored Walls.

fire, some archæologists in Ghent petitioned against its reconstruction, but lost their case, nobody at that time understanding the historical value of the old castle. It was only two years ago that some architects, antiquarians, and artists, under the guidance of M. de Maere de Limnande, formerly deputy of Ghent, succeeded in inducing the municipality of the town and the Belgian Government to acquire the territory, and to deliver the building from the parasitical constructions that overlaid it. To-day the ruins, being disengaged, present the aspect of imposing vestiges of a feudal fortress, of which no counterpart can be found save in Syria.

Such as the castle appears to day it constituted the citadel (kasteel, hof, burg) of a military town, separated from Ghent by the Lys. This town was the town of the Counts of Flanders (Gravenstad). Beyond the Lys there was an entrance yard (voorhof-voorburg), serving at one and the same time to protect the frontier and to hold in check the town of Ghent, which was the suburb or faubourg.

Of the Gravenstad no trace remains to-day, but its limits may be determined by the ancient ditches and the direction of the streets. It was bounded on the south by the Lys, on the west by the Lieve, on the east by the ancient ditch of Otho (actually the Sas Canal), and on the north by a canal, filled in and built over by the Rue des Corroyeurs.

The Gravenstad possessed four gates or bridges, like the Roman camps.

The principal gate was on the west, leading to Bruges (hoofe brugge, corrupted into "beheading bridge" because beheadings took place there. "Hoofe" in Flemish has the double signification of principal and head). It was the *porto decumana* of the Romans.

The Gate of the County on the south, giving access to the town of Ghent (*Grave brugge*).

Besides this there were the Gate of the Burg grave, or Viscount, on the north (*Burggraeve brugge*); later, the gate of St. Eloi, from the name of a neighbouring convent; and the Grey Gate (*Grauwe poort*), the *pretorium* of the Romans, giving access to the Wasda. Before this last gate stood a small castle (Chastelet), where the court of justice of the Wasda held its sittings.

In the interior of the Gravenstad, the Graven Kasteel, or Castle of the Counts, and their residence, stood at the north-eastern angle. The Church of Sainte Veerle, to-day of Ste. Pharailde, stood at the south-eastern angle.

The ruins of the castle as it was rebuilt by Philippe d'Alsace are in perfect preservation, though complicated by later additions, whose origin and purpose it is not always easy to determine.

We enter them by a gate on the place of Ste. Pharailde, which is still intact, and find ourselves in a low courtyard before a leave large and powerful keep. If we it to our right in passing between it and a building called a chapel,—though more probably it served as an arsenal (salle d'armes), surmounted by an upper story, containing, no doubt, the lodgings of the superior officers,—we arrive in an upper courtyard (kaets plaets, or tennis-court, cour du fin de paume) where two buildings abutting against the donjon may be observed, the one a kind of porch, the ancient chamber of archives or greffe of the tribunal of Flanders, and a covered Roman gallery. Under this yard are vaulted dungeons, that served probably as prisons. The whole is encircled by thick walls in good preservation, flanked by towers built en encorbellement.

Besides the entrance-gate, the chapel or arsenal, and in the upper court the building that we have named (the covered gallery), are remarkably well preserved. The keep, which formed a rectangular edifice of enormous dimensions and of a great height, is unfortunately partly demolished in one of its angles.

Beneath the building which we suppose to have contained the officers' quarters, connected with the keep by a mediæval vault of very curious construction, a subterranean prison of great interest has been discovered. Dungeons, or *oubliettes*, of whose purpose no doubt can be entertained, have been found also under the keep.

Excavations made on the south side of the keep have led to the discovery of a primitive subterranean story, evidently anterior to the overlying construction, which dates from the days of Philip of Alsatia. It has crenelated apertures upon a level with the soil, which seems to prove that it was only buried in consequence of the filling in of the upper court. It bears indications of having been constructed in the time of Baudouin bras-de-fer or Arnould le Vieux, 849.

This last discovery is of importance, as it testifies to an advanced art of construction among the Flemish people in that remote age, and which they introduced in all probability into England.

NOTES.

THE last number of the *Journal of Transactions* of the Institute of Architects contains a most important communication from Baron de Geymüller, suggesting no less a work than a grand monograph of the drawings left by the great masters of architecture from the fifteenth to the eighteenth centuries. Baron de Geymüller has himself done a wonderful amount of work, for one man, in disinterring and publishing original drawings of architects of the Italian Renaissance, and it is not surprising that his interest in the subject, so fascinating in itself and of such importance in the study of the history of architecture and of the design and carrying out of great architectural monuments, should have fired him with the idea that, with proper arrangement and co-operation, all existing documents of this kind might within a reasonable period be collected and published. Judging from his own experience, he believes that the methodical examination of the various European collections, and the photographing of from 5,000 to 10,000 drawings, might be carried out in the space of five years, with perhaps one year more for the publication of the catalogue, comprising three volumes and about 1,000 photographs of the smallest drawings. Baron de Geymüller had thought that one of the wealthy Americans of the day, many of whom take so much interest in art and archæology, might have been willing to find the funds for such a work, and with this end had already communicated with the American

Institute of Architects, asking the President to examine the project and communicate with him as to the best means of realising. The President, Mr. Kendall, stated that the idea had been received with enthusiasm by the Directors of the American Institute, and that they thought it possible to raise one-third of the funds for the work in their country, if the remaining two-thirds could be raised in Europe. Baron de Geymüller's letter to our own Institute is practically, therefore (though he does not say so in so many words), an invitation to us to consider what we in England can do towards furthering a project of such great interest. We have no doubt that the subject will be one of the first to receive attention when the Institute meets after the recess, and it is to be hoped that English architects will not be behind their brethren in America in endeavouring to assist the scheme. Such a collection would be a splendid possession for every important architectural library.

SIR ARCHIBALD GEIKIE'S address as President of the British Association is one of the class of addresses which cannot fail to have a popular as well as a scientific interest. It is a sketch of the progress of geological theory as to the age and the structure of the globe we inhabit, put in language intelligible to every educated reader. The salient point in the address is no doubt the reference to the modern dispute between the geologists and physicists as to the unlimited character of geological time. The geologists have regarded the extent of time behind them, for the formation of the earth's strata and remains as now existing, as practically incalculable; time was no element in the question, as far as our intellects can realise time. The modern physicists, such as Lord Kelvin, now aver that from the evidently high degree of heat still existing below the crust of the earth, and the estimated time occupied in cooling to its present state, an approximate limit must be fixed to the "backward and abysm of time" as far as regards the geological history of the earth. Lord Kelvin will allow us twenty millions of years behind us; but Professor Tait, less large-minded, cuts us down to ten millions of years. This is certainly a terrible reduction from the old vista of illimitable and uncomputable time, and no wonder the geologists feel rather blank at this reduction of their resources. Sir A. Geikie is of opinion that there must be some flaw in the physical argument, though he does not pretend to be able to say where it is to be found. But he states that at the present observed rate of sedimentary formation the existing strata of the earth's crust should have taken seventy-three millions of years to form, at the most rapid estimated rate of formation as now observed, or 680 millions of years at the slowest rate. "It may be argued that all kinds of terrestrial energy are now growing feeble, that the most active denudation now in progress is much less vigorous than that of bygone ages, and hence that the stratified part of the earth's crust may have been put together in a much briefer space of time than modern events might lead us to suppose. But," adds Sir A. Geikie, "no confirmation of this argument can be gathered from the rocks."

"On the contrary, no one can thoughtfully study the various systems of stratified formations without being impressed by the fulness of their evidence that, on the whole, the accumulation of sediment has been extremely slow. Again and again we encounter groups of strata composed of thin paper-like laminæ of the finest silt, which evidently settled down quietly and at intervals on the sea bottom. We find successive layers covered with ripple-marks and sun-cracks, and we recognise in them memorials of ancient shores where sand and mud tranquilly gathered as they do in sheltered estuaries at the present day. We can see no proof whatever, nor even any evidence which suggests, that on the whole the rate of waste and sedimentation was more rapid during Mesozoic and Palæozoic time than it is to-day. Had there been any marked difference in this rate from ancient to modern times, it would be incredible that no clear proof of it should have been recorded in the crust of the earth."

On the whole it seems to us that the balance of the argument is in favour of the geologists.

THE report which has just been presented by the Manchester Ship Canal Committee to the Corporation of that city will hardly be read with pleasure by the ratepayers. It states that at least one million and a quarter more money will be required, and it suggests that still further amounts than this may be necessary. We have steadfastly maintained that the Corporation of Manchester were not justified in becoming partners in a speculative commercial undertaking, even though such undertaking, if completed, should be of indirect benefit to the city. The present report shows in a stronger light that a community should leave such undertakings to private individuals. We regret also to have to say that the Corporation appear to have embarked in this business without taking proper precautions. The Committee state that it is to be regretted that the estimates first presented by the Company to the City Council, and the measurements upon which they were based, should have proved so unreliable. But if the Corporation were to find the money to complete the Canal, the first thing was to ascertain by independent investigation whether the estimates and measurements submitted by the Company were correct. The Corporation were coming to the assistance of what was practically a bankrupt concern, and therefore the utmost caution was necessary before one penny of the ratepayers' money was invested in the business. At present it looks very much as if not only the original shareholders would never receive one penny of interest, but also as if the Corporation would have to go without any interest on their first advance. It is constantly forgotten that the Ship Canal will have to bear the brunt of a keen competition by the railways. It stands on altogether a different basis from the Suez Canal, and every million more money that is put into it weights it more heavily as a commercial undertaking.

DR. TRISTRAM, Q.C., Chancellor of the Diocese, has delivered judgment in the matter of the faculty for St. Mary-at-Hill, by Eastcheap. On May 9 last an Order in Council was issued for the removal to Norwood Cemetery, or some other consecrated burial-ground, of all human remains (very great in number and near to the surface) beneath the floor, consequently upon the reports of Dr. Hoffmann, of the Home Office, and of Dr. Sedgwick Saunders, Medical Officer of Health for the City, coupled with the churchwardens' evidence. The necessity of carrying out sanitary measures of this kind has been advocated in our own columns.* Inasmuch as the cost, estimated at from one to two thousand pounds, will far exceed the moneys now allotted for repairs and extraordinary expenses, Dr. Tristram pointed out that, under the Charity Commissioners' scheme in respect of the parochial property, application could be made by the churchwardens for an appropriation in this behalf. The Commissioners lately divided the parish funds into two amounts,—the one of 865*l.* per annum as church or ecclesiastical property, the other of 1,331*l.* per annum for general purposes. The church, which since the Fire has served for the united parishes of St. Mary-at-Hill and St. Andrew Hubbert, was closed in October last. It contains some carving ascribed to Gibbons, with that executed by Rogers for the repairs of 1848-9; and a baldachino of Flemish workmanship. The organ (since enlarged) was built by Hill from the designs of the then organist, Mr. F. C. Burrowes. Wren re-built the domed interior, altered, we believe, by James Savage (the architect of St. Luke's, Chelsea), and the existing east end; the side walls, the west end, and the tower were subsequently reconstructed in brick.*

* See "Note" in the *Builder* of February 27 last.

THERE can be very little doubt that the contention of the London County Council, in the arbitration before Sir Frederick Bramwell, in regard to the basis on which the tramways are to be purchased, is the right one. The contention of this body is that they are only bound to pay for the actual structural value, without regard to any profits which may be earned by any particular part of the undertaking. Such seems to be the meaning of the Act of Parliament which empowers the Council to purchase the tramways. The question cannot now be decided until after the Long Vacation; but there is no particular reason for hurry in the matter.

THE records of the Patent Office are sometimes curious reading. At least one patent, and probably more than one, has recently been taken out for utilising the energy of tramps. The idea is to reverse the penny-in-the-slot machine, to provide a handle for your tramp to turn, doing some useful work such as grinding coffee or charging accumulators, and when he has done a pennyworth a penny comes out of the slot. The difficulty is that, apart from the fact that tramps have seldom any spare energy, mechanical work is so cheap that even an industrious and starving man might hesitate to sell his labour at the market price. Mr. Crompton estimates the sheer cost of energy at 2d. a unit. At this rate a man would have to work hard from three to four hours for his penny. If, on the other hand, the payment were raised to a price which would tempt the unemployed, say a penny for five minutes' easy work, we should soon find some enterprising individual taking round a small motor and a couple of accumulators, to sell dear to the automatic machines energy which he buys cheap at a central station.

THE *Daily News* states that Cumnor Park will shortly be offered for sale. Of Cumnor Place, latterly known as Dudley Castle, or Cumnor Hall, scarcely any vestige remains. Anthony Forster, *obiit* 1572, devised it to the Earl of Leicester, but it remained for long uninhabited save by, as the vulgar fully believed, their victim's shade. For two centuries and a half it has belonged to the Berties, Earls of Abingdon. Cumnor had been a retreat or pleasaunce of the mitred abbots of Abingdon, and is considered to have been built by William de Comenore, elected abbot in 1331. At the suppression, Thomas Rowland (or Penthecost), last abbot, had a grant for life of the manor, which the King then gave, Oct. 8, 1546, to his physician, George Owen, whose son William sold it in 1561 to his tenant, Anthony Forster. On Sunday, Sept. 8, 1560, Amy Robsart met with her death: on the 22nd of that month her body was finally laid in a brick vault beneath the choir of St. Mary's, Oxford.† In the chancel of St. Michael's, Cumnor, is the rich altar-tomb of Forster, with brasses of him, his widow, and their children: his epitaph describes him as a very worthy man—a great musician, builder, and planter. He made some alterations, in the Tudor style, at the Place. The house itself, built of stone, and roofed with slate, lay around a quadrangle, 72 ft. by 52 ft., and had seven rooms on the ground-floor. Along the west side stood the hall, 44 ft. by 22 ft., having an

* Writing to the *Times* of April 16 last, Mr. H. C. Richards says:—"When the church was threatened with removal by a clause of the Inner Circle Railway Bill, the City Church and Churchyard Protection Society was founded, and Mr. Percy Wyndham led an opposition in the House of Commons which secured the abandonment of the obnoxious clause, and induced a number of his fellow-members, including the Chairman of Committees, to visit the church, which ranks next to St. Stephen's, Walbrook, and has the finest pulpit and organ-gallery in the City."

† Her ancestor, Sir John, *obiit* 1450, was buried in St. Francis's Chapel, Grey Friars (Christchurch), Newgate-street. She was born, it appears, at Stanfield Hall, Norfolk, where Rush murdered Isaac Jermy and his son, in 1848.

open timber roof, its outer walls being 3 ft. thick and 14 ft. high, supported by buttresses; in the south-east angle stood the chapel; the staircase down which Amy Robsart is said to have been thrown was a newel staircase, giving access to the Long Gallery.* In or about 1750 Cumnor was let to a farmer and maltster, who converted it to the uses of his business. Eighty years ago most of the materials were taken for the re-building of Wytham Church, Berkshire, and what remained has gradually been demolished. They placed two traceried windows in the new church, an arched doorway from the hall in the church porch, two other doorways in the tower and in the wall between the churchyard and Wytham Abbey, Lord Abingdon's seat. We gather that at Cumnor no relic remains of the house excepting a portion of the east side abutting against the churchyard.

THE news that the Royal Exchange is to be decorated with a series of paintings, of which the first will be contributed (as a gift) by the President of the Royal Academy, and the remainder are to be executed by other eminent painters in accordance with a general scheme for the whole series, must be welcome to all who wish to see art a subject of more general interest in this country. An undertaking like this on the part of a purely commercial society shows that some real progress has been made in this direction in England.

LETTER FROM PARIS.

THE Government, which for twenty-two years has put up with the melancholy spectacle of the ruins of the Cour des Comptes in the very middle of Paris, has nevertheless ordered the entire destruction of the ruins of the palace of St. Cloud. The decision is to be regretted, both from the picturesque and the historical point of view. The ruins in their present state, overgrown with ivy and wild flowers, present no forbidding appearance, and, in fact, form a very attractive feature in the wooded landscape in which they stand. No explanation has been given for the decision, against which the inhabitants of St. Cloud have at the last moment, strongly protested. But these remains of a historic place have been sold to a contractor for the paltry sum of 3,000 francs, and in a few days the pick and shovel will have destroyed the remains of this great Imperial residence.

As the destruction of such a building may lead to interesting discoveries among the ruins, the State has reserved an exclusive right to all objects of value, documents, money, medals, jewels or statues which may be discovered in the course of the demolition. On the other hand, the contractor, M. Kasel, remains proprietor of the splendid "frontons," which, in spite of fire and bullets, are in sufficiently good condition, and of which he hopes to make a good sale; and some of this work no doubt will prove a treasure to amateurs of historic and artistic curiosities. Green sward will soon occupy the site of the palace where "Monsieur," the brother of Louis XIV., gave the splendid fêtes the record of which is preserved in contemporary literature. It may be remembered also that at St. Cloud died Henrietta, daughter of Charles I. of England, and that two Sovereigns, Charles X. and Napoleon III., at an interval of forty years, each passed in this palace the last year of his reign, the one before his exile, the other before his defeat and captivity,

Last week, the public were admitted to the École des Beaux-Arts to see the exhibition of the works of the competitors for the Prix de Rome in painting and sculpture. The subject given for painting was the affliction of Job, but unfortunately the competitors had none of them entered into the feeling of the subject, the submission of Job to his calamities; they had only represented, more or less successfully, an old Italian model well known in the school, with an aspect more or less sordid. M. Lavergne, the pupil of MM. Lefebvre and Lévy, who had the second Grand Prix in 1890, has obtained the first one this year. He has real qualities as a colourist, and more of artistic sentiment than his fellow-students. The second prize was given to M. Mitrecey, whose picture seems to promise well for his future; he is the pupil of Lefebvre and Tony Robert-Fleury. In sculpture the subject was also taken from the Old Testament,—Adam driven from Paradise to till the ground. The subject has been in the main well treated by the ten competitors in this branch of art. The first prize has been awarded to M. Hippolyte Lefebvre, pupil of M. Cavalier, who has certainly treated the subject best. His figure represents Adam standing near a bush of brambles, leaning on a knotted branch and wiping the sweat from his face; the expression of the face is energetic, the torso finely modelled. M. J. Marie Clausade, to whom the second prize was awarded, has learned from his master, M. Falguière, a vigorous style of work. M. Emile Delépine, another pupil of M. Cavalier, also obtained a second prize. These two last-named competitors, instead of representing the first of men at his labour, have preferred to represent him wearied, meditative, and apparently regretting his lost Paradise. The result of the competition in architecture is not yet known: the subject given is "La Façade et les Plans d'un Musée d'Artillerie."

Before separating, the Municipal Council have definitely decided the question, which has been discussed for eight months, of who should succeed M. Alphand. Not finding any one capable of assuming the responsibility of the sole directorship of the works of Paris, they have preferred to make a division of the Empire of Alexander. The waterworks, the drainage, the roads and lighting, the public works of the Department, in particular that of the city of Paris, the public carriages, the public ways, the plan of Paris, fine arts, architecture, and, in a word, all this great administration which M. Alphand held in his hand, and which made him a more powerful Minister than even the Prefect of the Seine, has been divided and given to other municipal bodies. Architecture, which, by the way, had suffered not a little by being under the direction of an Engineer of Ponts et Chaussées, will now be under the authority of an Inspector-General, M. Bouvard. Fine Arts and historical works are placed under the immediate superintendence of the Prefect of the Seine.

The Fine Arts Academy have proceeded to the election of the member who was to replace M. Bonassieux. As was predicted, M. Frémiet won easily, by 21 votes out of 35. M. Allar had three; MM. Lançon, Coutan, Injalbert, and Cugnot had each two; and M. Tony Nöel only one. The new Academician is one of the most brilliant of Rude's pupils. He was born in Paris in 1824, and bears his sixty-eight years well. He was first brought into notice by his models at the École de Médecine of anatomical pieces, which were intended for the Orfila Museum. In 1843 he sent a gazelle to the Salon, which attracted much notice. Six years later he sent a wounded dog running, which is now in the Luxembourg Museum, and which is quite equal to any of the best works of Barye. Having been obliged, to gain a living, to model and paint the zoological plates for the Museum of Natural History, he acquired in this work that accurate knowledge of animal anatomy which is a special feature of his work. His conceptions are all based on a scientific study of nature. Beside his marvellously truthful animal sculptures are also to be noted his numerous graceful statuettes in bronze and terra-cotta. But his leading works, those which establish him as an incontestable master in modern sculpture, are the Jeanne d'Arc in the Place des Pyramides (illustrated in the *Builder* for August 3, 1889) which he modified and altered for the town of Nancy; the Louis d'Orléans for the château of Pierrefonds, the statue of Condé at Chantilly, the "Velasquez" (of which an illustration appeared in these pages on July 5, 1890), and lastly the "Olivier de Clisson" exhibited this year at the Salon.* It may be mentioned also that M. Frémiet is now executing the monument to Raffet which is to form a pendant to that of Meissonier in the "Jardin de l'Infante" at the Louvre.

The exhibition of "Arts de la Femme" has just been opened to the public. This exhibition, organised at the Palais de l'Industrie by the Union Centrale des Arts Décoratifs, is under the management of M. Marius Vachon, a learned art-critic who has spared no pains to collect here everything in art industry which has been created purely for woman and made exclusively by women. The collection is very interesting, and among its attractions is a diorama by M. Poilpot, in which, under the title "La Parisienne du Siècle," the author has represented the transformation from the fashions of 1790 to those of to-day.

We have to record the death of M. Frédéric Lœwe Marchand, painter, at the age of 38. He had been a pupil of Pils and Luminais, and had devoted himself to historical painting and portraiture. He gained a third medal in the Salon of 1883 for his picture of "Belisarius," and a second medal in 1885 for his "Supplice d'un Prisonnier de Guerre," which was purchased by the State. At the 1889 Exhibition a bronze medal was awarded to this modest and sincere artist, who has died in the prime of life, much regretted by all who knew him.

THE ROYAL COMMISSION ON METROPOLITAN WATER SUPPLY.

WE continue our report* by giving the proceedings at the last two sittings of the Commission, and embodying other evidence which we have had to hold over, but arranging it so as to bring together the evidence of witnesses speaking to cognate subjects.

The Thames Conservancy's Inspection.

Mr. Gough, Secretary to the Thames Conservancy, produced three voluminous tabular statements with reference to which he was examined at considerable length. The first was a list of towns, villages, and other places on the Thames and its tributaries above Staines, showing in columns the population, how many visits were paid by the inspectors of the Conservancy, whether any and what pollution had been detected, and what remedial measures had been adopted. This list extended to twelve sheets, brief size, containing over twenty-five names on each sheet. Some places were visited once or twice a week, some once or twice a month, some at longer intervals, and some had not been visited at all, owing to difficulty of access and want of time on the part of the officers. In many cases no pollution had been detected; in others it had been detected, and in most of these, but not all, it had been diverted. A second list contained the names of seventy-six places from which the passing of sewage had been stopped. Details were given in each case. The third was a list of twenty-two places where sewage works of a character more or less systematic had been executed with the details of such works. This table gave in columns the population, distance from river, extent of land, method of treatment, descriptive remarks, high and low levels of works and stream, top-soil and geological formation, and what becomes of any effluent. (The table was an amplification of one already presented and summarised in the *Builder* of June 25, p. 503.) The towns discharging effluents are Oxford Abingdon, Reading, Maidenhead, Chertsey, Cirencester, New Swindon, Old Swindon, Witney, Wokingham, High Wycombe, and Uxbridge. In other cases there is no effluent outlet and the liquid is absorbed.

In answer to questions, Mr. Gough said that in the summer the inspecting officers had many regattas to attend to, and were not able to devote so much time as in the winter to the work of inspection.

The Chairman: In other words, the inspection is less efficient in the summer than it is in the winter.

Mr. Gough: So far as it is done at all, it would be done as efficiently for a less time in the summer as it is in the winter.

The Chairman: Of course, the fact that there is less time devoted to it in the summer is perfectly well known to everybody concerned.

Several questions were put as to the manner in which the information embodied in the returns had been obtained.

The Chairman said: It really represents an inquiry undertaken for our benefit, in consequence of what took place when you were here before.

Mr. Gough: Yes, our former statement had

* See A. D. Bartlett's painstaking volume, *ad hoc*, 1850. He shows that the long account in the *Gentleman's Magazine*, 1821, is in many respects inaccurate.

* Of this work an illustration will appear in the next number of the *Builder*.

* See last volume of the *Builder*, pp. 418, 435, 456, 480, 503; and current volume, pp. 10, 29, 47, 71, 82.

been prepared hurriedly, and the levels had not been taken by observation.

He added that about 3,600 inspections were made in a year, and explained what was done in the way of giving notices and making complaints and representations before formal notice was resorted to.

Mr. Mansergh observed that, dividing the population by the acres, there were at Oxford 1 acre to 136 people; at Abingdon, 1 to 134; at Cirencester, 1 to 133; at Reading, 1 to 76; and at Maidenhead 1 to 530. The Maidenhead effluent was as good as that of Reading. An Oxford sample was found to be good, and one from Cirencester as good as the Thames water there.

Professor Dewar: Would the Conservancy accept 1 acre to 500 on laying out new farms?

Mr. Gough: If the Conservators can keep the river fairly pure, and free from a bad effluent, it is hardly within their jurisdiction to decide on the extent of a sewage farm.

Some surprise was expressed by Professor Dewar at learning that not more than about two dozen analyses of effluents were made in a year, because analyses were costly; but Professor Dewar said they need not be if they were limited to the question of purification from organic matter.

It appeared that between 1887 and 1892 there had been fifteen adverse reports as regards Oxford, but of course many more inspections without such reports. Up to that moment he was not aware of the existence of Mr. Binnie's map of pollution, based upon the reports of Dr. Fosbroke and Dr. Ashby.

The Chairman: The fact that your inspectors found certain places in the condition they describe is not inconsistent, is it, with their being in the condition which is described in these other reports which we have got at other times?

Mr. Gough: No, it is not, but, with some exceptions, our inspection has been pretty constant. What the other witnesses discovered were mostly cases of slop pollution; they had very great difficulty in finding a higher kind of pollution.

The witness afterwards explained that inasmuch as a sewage notice gave a delinquent twelve months' grace, and further time was lost in proving continuous pollution, it was often possible to do more by courteous letters than by notice. Their own Act was better than the Rivers Pollution Act, and, with further powers and more funds, he believed they could accomplish all that was desired.

The witness handed in a correspondence between the Board and the Southwark and Vauxhall Company. The Board called attention to the fact that the figures in the report of Dr. Frankland showed that the Company had been drawing from the Thames more than the authorised 24½ million gallons daily. The Company simply said that, although the total supply had exceeded that, a large quantity had not been drawn from the river, and when the deduction was made the limit had not been exceeded. The Board asked for fuller explanations. The Company asked for an interview, which was granted. The last letter explained that the return made no allowance for loss, slip, or variation in the length of stroke of the engine. Further, a large amount of water was obtained from the "natural collecting works at Hampton," and a good deal of water used for sand-washing purposes was returned to the river.

Mr. C. E. Groves, F.R.S., handed in the results of the analyses of four samples of water taken from the Thames on April 21, 1892. The results were almost identical with those given by samples analysed last year; these samples, however, contained rather less free ammonia, and there was less of easily oxidisable organic matter as indicated by the permanganate test. Mr. Groves said he differed from Dr. Frankland by preferring the albumenoid ammonia process to the combustion process of Armstrong & Frankland, because the former differentiated between easily decomposable nitrogenous matter and the total nitrogenous organic matter, a portion of which might not be easily decomposable. Therefore the albuminoid process was more valuable if we wanted to ascertain whether the water was polluted to any extent. He did not agree with Dr. Frankland that the relative value of the oxygen determination was of more importance than that of the albuminoid ammonia. He was aware that in the case of London waters the relative oxygen was very nearly in exact proportion to the relative amount of absolute carbon; but it was not the case with effluents. The oxygen required in an Oxford sample was 0·49, and in a Maidenhead sample 0·35; in the first the albuminoid ammonia was 0·5 parts per million, and in the Maidenhead sample ·19; so that by the oxygen required the Maidenhead sample was the better, and by the albuminoid ammonia it was four times as bad.

Lieut. C. E. Bell, R.N., the Conservancy's chief inspector of the river between Cricklade and Staines, described the methods adopted by him and his assistants in doing their work. The length of his portion of the main river was 130 miles. They looked out for water-courses likely to carry drainage and went up to the villages and houses passed by them. Sometimes there had to be a house-to-house visitation. They went completely round sewage farms, and if the effluents were turbid or smelt they took samples and sent them in with their reports. They also communicated with the persons in charge of the farms, and continued their visits even while correspondence was going on. Samples were not taken merely on account of "bad appearance," so that when that complaint was made of Reading in 1890, 1891, and 1892, no analyses were made. Winter was often the worst time on sewage farms, because floods were sources of danger, whilst when the ground was hard it did not absorb sewage. Although he was diverted from river work in June and July, his two river-keepers were not; he also had an assistant, and no one had any notice of visits of inspection. A clear effluent with a bad smell would be reported adversely, but a clear effluent without smell would be reported as "no apparent pollution."

Mr. F. A. W. Drummond, assistant inspector under Mr. Little between Staines and Teddington, described the condition of things at Staines, where he had reported that a "feeble attempt" was made to deal with pollution by sewage. The pollution still existed. Drains discharged directly into the Thames, the Colne, and ditches that polluted the rivers. There have been regular and special reports of this pollution for ten years. The Conservators have served notices in 121 cases. In some, owners or occupiers have cut off the connexion of their closets with these drains. In these cases action or notice may occupy thirteen months. He was afraid that the other duties of the officers interfered with a regular proper inspection.

The Lea Conservancy and Sewage Farms.

Major L. Flower, of the Lea Conservancy Board, having been asked in his original examination, by Professor Dewar, whether he could complete a table he had handed in, now produced an additional statement as to the disposal of sewage on land above the intakes of the water companies in the watershed of the Lea. The table shows (1) the population of the place, (2) the daily flow of sewage in gallons where it can be ascertained, (3) the area of the land employed, (4) the value of the soil, and (5) the height above the ordinary water-level of the river, and certain other details. In the following, we omit the column for the daily flow of the sewage, as it is ascertained only in three cases, and we give the nature of the soil with the descriptive remarks, but we give the population and the area in table form, because the proportion between them is often mentioned in the examination of witnesses:—

	Population.	Acres.	Height—ft.
1 Luton	30,005	94	20 to 200
2 Wheathampstead	2,319	4	10 to 12
3 Hatfield	4,059	unlimited	10 to 37
4 Whitwell	500	4	5 to 8
5 Buntingford	2,000	5	9 to 12
6 Hadham	1,398	4	8 to 10
7 Bishop's Stortford	6,693	120	200 to 270
8 Harlow	1,900	7	4 to 8
9 Sawbridgeworth	3,049	..	50 average
10 Stanstead Abbots	1,200	12	100 to 150
11 Ware	5,121	114	10 average
12 Hoddesdon	2,681	17	20
13 Broxbourne	1,000	9	12 to 15
14 Waltham Abbey	6,066	12	10 to 15
15 Cheshunt	9,620	23	10 average
16 Royal Small Arms Factory	2,500	20	8 to 10
17 Epping	1,300	34	40

Daily flow of sewage in gallons: Luton, 1,250,000; Bishop's Stortford, 633,225; Cheshunt, 130,000; Wheathampstead, very small.

1. Chalk. Pumping scheme; farm may be considered 80 acres; sewage absorbed in chalk; ¾ of a mile from river; night sewage stored in tanks; overflow to ¾ of an acre of land, planted with oziers, and to filter.

2. Light, porous, sandy. Gravitation scheme; overflow of tanks absorbed in soil; small sewage-farm 60 yds. from river.

3. Loam and gravel. Gravitation scheme; land used intermittently, 50 acres at a time; 100 yds. from river.

4. Light soil on chalk. Gravitation scheme; overflow of tanks absorbed in soil; 30 yds. from river.

5. Light loam over gravel. Gravitation scheme; sewage absorbed in soil; close to river; some houses not connected with sewers.

6. Light gravelly soil. Gravitation scheme effluent to the river Ash; close to river.

7. Gravel and sand over chalk and clay. Pumping scheme; 22 acres recently added to farm; part of the night-flow filtered; effluent to the Stort; ¼ mile from river.

8. Peaty, well drained. Gravitation scheme; part of parish only sewered; provision for about 400 houses; many not connected.

9. Light loam. Gravitation scheme; chiefly absorbed in soil; ½ mile from river.

10. Light gravelly soil. Pumping scheme; farm laid out carefully since 1886; cause of complaint removed; 1 mile from river.

11. Drift gravel and sand. Pumping scheme; sewage absorbed in the soil; close to river; about 70 acres used for sewage disposal, rest being flat land, adjoining river.

12. Free gravel. Gravitation scheme; sewage now well dealt with; absorbed in soil; ¼ mile from river.

13. Light gravel soil. Gravitation scheme; sewage absorbed in soil; about 100 yards from the river.

14. Loam, sand, and gravel. Pumping scheme; effluent to Cobbins' Brook and Cholera Ditch, adjoins both; ¼ mile from river.

15. Gravel and sand. Pumping scheme; effluent to intercepting drain of East London Waterworks, discharging below the intakes.

16. Loam, sand, and gravel. Pumping scheme; effluent to back river at Enfield Lock; close to river.

17. Loam. Gravitation scheme; sewers are constructed for a special district with two outfalls,—one in Lindsay-street (drained 4 ft. and 5 ft. deep), the other on Shaftesbury Farm, and used by the tenant on his land; 260 houses connected to sewers, each outfall taking about half.

In answer to Professor Dewar, Major Flower said that there were seventeen places which disposed of their sewage under a certain system on land. There were small places which disposed of it without any system, by pouring slops on the ground. He had excluded Hertford, which treated its sewage chemically in tanks, and Welwyn, where it was treated in in tanks and filtered through straw, and had confined the list to land treatment, with or without chemical treatment. To Mr. Mansergh he said there had been much misunderstanding about Wheathampstead; it was a very small place; the flow of sewage was very small, and it was collected in two tanks, 70 ft. in length, and 9 ft. in breadth. There is no public water supply, and there are very few water-closets. The small sewage farm has sometimes been called a sewage garden. There is a small barrel of lime; lime-water is used to keep the smell down, although it really increases it. At the Small Arms Factory and Epping there are no tanks, only pumping wells and screening chambers; and no chemicals are used. Many of these places are near the river; but care is taken to keep the water out of the river; it all passes through land. To Sir G. Bruce he said that treatment by land was far superior to treatment by chemicals. Where chemical processes are employed the river is reached by contamination such as you do not find when land is used. All that was mentioned in this return was practically a fair and effective treatment of the sewage question in the way of keeping mischief from the river. At Buntingford there was no effluent from the farm; it was entirely absorbed in the soil. Some houses were connected with cesspools only, and he was trying to get all the houses connected with the sewers. At Hadham there is a visible effluent which, as a rule, is very fair. There is a great difference in the areas of land for these places; but in each case it is sufficient. Hoddesdon has pure sewage land not now used for cultivation, and the sewage is allowed to soak into the ground. Professor Dewar pointed out that Wheathampstead, Whitwell, and Hadham had all the same areas for different populations; and the witness said that at Wheathampstead perhaps no more than 1,000 people drained into the sewers, and the rest of the sewage was disposed of in detail. Therefore, the table did not support any inference as to the area of land to be used for a given number of people in all cases.

Professor Dewar said he was under the

impression that the table would enable them to come to a judgment as to the number of persons whose sewage could be disposed of on a given area; but the witness said no, it would not. In the cases of Stanstead Abbots and Waltham Abbey, one having five times the population of the other, the disposal of the sewage on equal areas was equally satisfactory. In answer to Sir A. Geikie, the witness said that Luton was the only place where he had observed springs issuing from the chalk between the level of the sewage farm and the stream. Analyses showed that there was no appreciable injury caused to the spring by the disposal of the sewage by absorption in the chalk. The distance between the sewage farm and the issue of the spring was over half a mile, but there was a piece of land 100 yards from the spring on which sewage was sometimes put and allowed to soak.

The Sewage of Hertford.

Mr. C. E. Longmore, Town Clerk of Hertford, handed in several statements on behalf of the Corporation. One by Mr. Longmore recited that in 1884 the Lea Conservancy sought to obtain an injunction to restrain the Corporation from discharging their effluent into the Lea. After a long hearing and inspections, Mr. Justice Watkin Williams gave judgment that no real injury, pollution, or nuisance was caused, that the effluent could not be injurious to the consumers of the water supplied by the East London Company, and that the objection, therefore, is a sentimental one, and if it is removed it should be at the expense of the Company,—a principle recognised by the New River Company, who commenced negotiations with a view of taking over the treatment of the sewage of that town. The Corporation have had the effluent analysed several times by the late Dr. C. M. Tidy, Dr. Thomas Stevenson, and Dr. Turner. Schedules showing the results of these analyses were annexed. The Corporation strongly object to any greater quantity of water being taken by the Companies from the Lea Valley, and upon this branch of the case entirely support the action of the Hertfordshire County Council. In his examination Mr. Longmore said towns ought not to be rated to keep up the rivers to the standard of drinking water for London. The town took its waters from deep wells which belonged to the Corporation. There had not been any complaint about the lowering of the water in these wells. The New River Company spent a considerable sum in sewering Hertford and in constructing the works, and would object to have any land in the neighbourhood used for casting the sewage over it. The work was done under an Act of 1854. Mr. Hill said "It is a curious arrangement;" and the witness said the reason for it was that the sewage used to go more or less directly into the River Lea above the intake of the New River Company, but by constructing these works they got the sewage of Hertford treated, and ensured the discharge of the effluent below their intake. Still the town had no right to discharge an effluent which would be a nuisance at common law.

Dr. Thomas Stevenson, Scientific Analyst to the Home Office, made a statement, in which he said he had often been consulted since 1883 by the Corporation of Hertford as to their system of sewage purification, and he had repeatedly visited the works, and taken samples of the effluent. He invariably fixed his own time for the visits, and he gave evidence on behalf of the Corporation at the trial before Mr. Justice Watkin-Williams in 1884. He was acquainted with the analysis of Dr. Tidy, which showed the effluent to be a very good one. Dr. Tidy's analysis of the Lea water above and below the sewage outfall showed the difference in quality to be but slight. The precipitation process used at Hertford was one of the best that is known. The resulting effluent is good and highly dilute, and, except for the very faint odour produced on agitation, it might often be mistaken for a drinking water. Samples kept well without showing putrescence. In the Cut a visiting-card could be read at a depth of 3 ft. The blackness at the bottom of this Cut and of the mud of the Manifold Ditch was due partly to the use of green vitriol in the precipitating process and partly to the peaty soil through which the ditch flows, and is of no consequence. On looking at the mud through the colourless water, the water had a deceptive appearance of blackness. He had never been able to detect sulphuretted hydrogen in the effluent or evolved from the Cut. The nearly invariable presence of iron salts must prevent the evolution of that gas. The effluent might be safely run into any river of sufficient volume, such as the Lea, where the effluent becomes diluted with fifty times its volume of water. The effect on the river is insignificant, and all appearance of sewage quickly disappears below the outlet of the Manifold Ditch. The effluent could not appreciably effect the river fifteen miles lower down. Sewage fungus merely affords evidence that the conduits contain sewage effluent. The fungus is *per se* inodorous. It appropriates the sewage constituents as part of its tissues, and, if uprooted, it dies and decomposes. Among the products of its decomposition are sulphur compounds, but, in the presence of dissolved iron salts in the faintly alkaline water, there can be no evolution of sulphuretted hydrogen. There is, however, a formation of black sulphide of iron, a substance which gradually oxidises without evolution of sulphuretted hydrogen, and without offence. The small amount of sewage fungus which goes into the Lea cannot harm the stream a little lower down. The only possible danger attendant on the admission of the effluent is the introduction of specific or pathogenic organisms. There is no evidence, however, that these organisms can survive large dilution, the influences of light, oxidation, and a flow of more than a dozen miles in a river. Hence, he apprehended no danger to the filtered London water supply, from the introduction of the Hertford effluent into the Lea.

In examination, Dr. Stevenson said he had been consulted during the last ten years by the Corporation of Hertford as to their system of sewage purification. He handed in some tables of analyses for the years 1883–86 and 1891. The treatment was precipitation and transmission through a cut with exposure to air before discharge into the river. The manager would vary at his discretion the usual proportions of 3 to 5 grains of the mixed sulphates and about 10 grains of lime. The peculiarity of the effluent was its high dilution, brought about by the infiltration of subsoil water into the drain. The sewage was diluted with something like ten times its volume. The mud of the Manifold Ditch was undoubtedly black, but the blackness was due to the presence of the sulphide of iron. The surrounding soil is black, somewhat peaty, and yielded traces of sulphides. It evolved sulphuretted hydrogen when treated with acids. The soil taken from the ditch had not the bad smell described. The fungus was always associated with a large proportion of sewage, but it was not confined to sewage. He had not met with the same fungus in England, because he knew of no watercourses containing sulphuretted hydrogen in the water. That may be produced by the decay of the fungus; it grows in waters that are fairly pure organically, but contain sulphur compounds. In this country it was generally found associated with a contaminated stream. When the fungus decayed, it produced sulphuretted hydrogen, and increased that form of pollution, unless there was something in the water which restrained the evolution of sulphuretted hydrogen,—iron, for instance. After the treatment of the Hertford sewage, there was sufficient iron left in solution to prevent the evolution of sulphuretted hydrogen. Only once had he failed to detect the presence of dissolved iron in the water of the cut right away down to the weir, where it fell into the ditch. The most effective way of treating sewage was to precipitate, and then filter through land, but there were difficulties in doing that at Hertford, one of them being the contiguity of the deep wells of the New River Company. It was doubtful whether pathogenic organisms would survive a run of 15 miles down to the intakes of the companies. He did not think the effluent interfered with the wholesomeness of the water. He preferred land treatment if it were practicable; but he did not see where land was to be had near Hertford at a lower level.

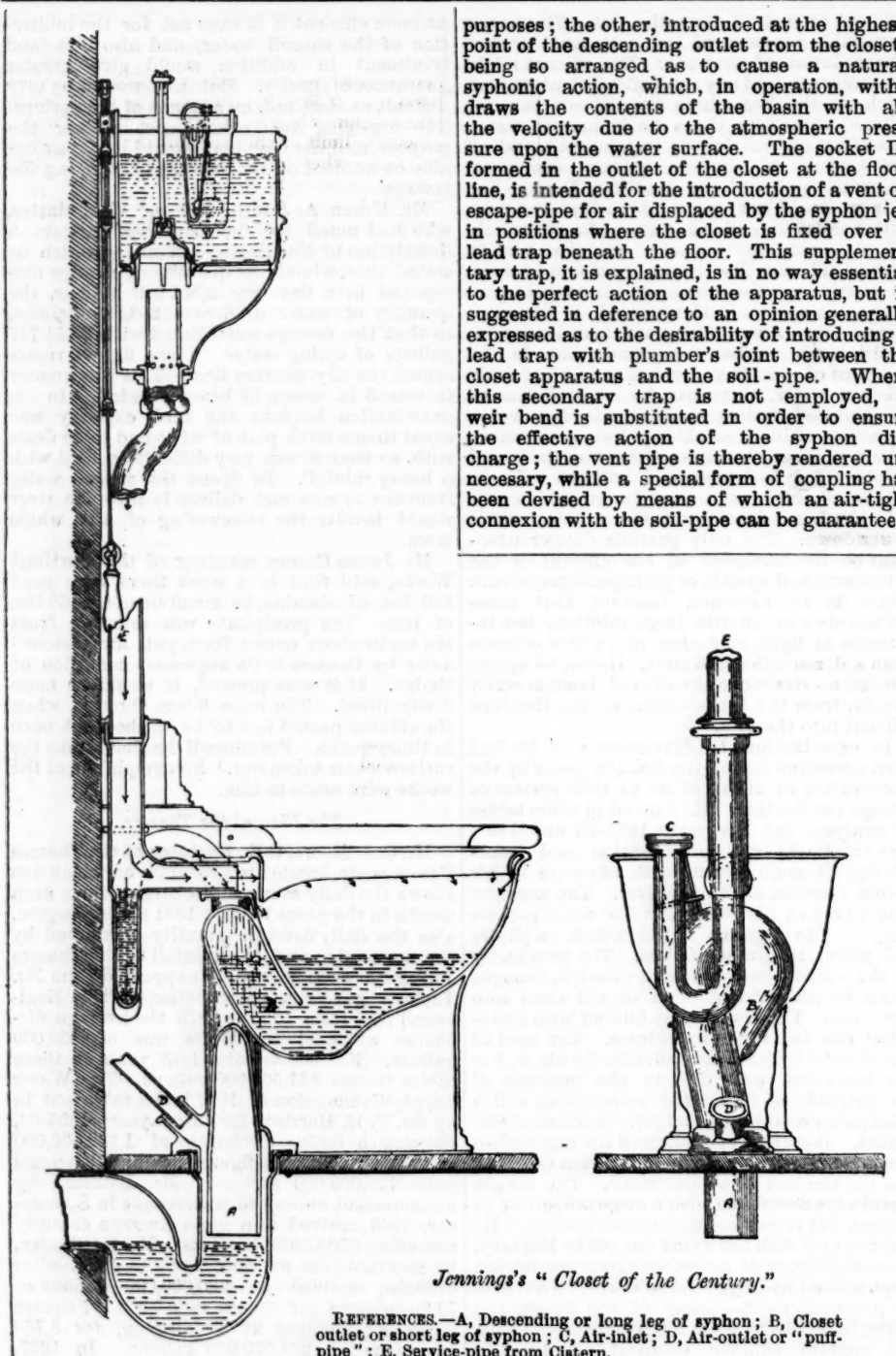
Dr. Geo. Turner, Medical Officer of Health for the borough of Hertford, submitted a statement in which he said that his analysis showed the effluent to be a good one. The sewage after it reached the sewage works was mixed with alumina, sulphate of iron, and milk of lime. He described the process and said that long acquaintance with the works had convinced him that the treatment at Hertford was a good one, and gave a good effluent. In examination he said he agreed with Dr. Stevenson that the precipitation process would be more efficient if it were not for the infiltration of the subsoil water, and also that land treatment in addition would give greater guarantee of purity. But that would be very difficult at Hertford, on account of the springs. The low-lying land would not answer the purpose, and the high land would be objectionable on account of the expense of pumping the sewage.

Mr. Urban A. Smith, C.E., of Westminster, who had acted for the Conservancy, gave a description of the Hertford Works in which he stated that, whilst the quantity of sewage discharged in a day was 2,362,982 gallons, the quantity of water used was 208,235 gallons, so that the sewage was diluted with 2,154,747 gallons of spring water. These figures represented the dry-weather flow. This was greatly increased in towns of heavy rainfall. In his examination he said the tank capacity was equal to one-sixth part of what had to be dealt with, so that it was very difficult to deal with a heavy rainfall. To divest the subsoil water from the sewers and deliver it into the river would involve the re-sewering of the whole town.

Mr. James Cramp, manager of the Hertford Works, said that in a week there were used 186 lbs. of alumina, as much lime, and 68 lbs. of iron. The precipitate was removed from the tanks about once a fortnight, and fetched away by farmers in its unpressed condition of sludge. If it were pressed, it would be more easily lifted. The coke filters through when the effluent passed had to be washed out once in three weeks. For himself he should like the surface water taken out. No complaints of the works were made to him.

The Flow of the Thames.

Mr. C. J. Moore, C.E., Engineer of the Thames Conservancy, handed in a diagram on which was shown the daily average discharge during each month in the years 1883 to 1891 at Teddington, also the daily average quantity abstracted by the companies, and the rainfall in the Thames Valley for each month. It appeared from Mr. Taylor's gaugings (Transactions Civil Engineers) that from 1853 to 1873 the average discharge at Seething Wells was 800,000,000 gallons. For the twenty-eight years in these tables it was 857,500,000 gallons. The Water Supply Commission of 1867 had a table put in by Mr. T. H. Harrison for eleven years, 1855-66, showing a daily discharge of 1,352,000,000 gallons. Mr. Taylor's figures for the same years gave 788,000,000 gallons. Mr. Bateman by measurement above the waterworks in September, 1865, arrived at a gross average scarcely exceeding 300,000,000 gallons. Mr. Hawkesley, by measurement at Bray Lock in 1851, after drought, arrived at 200,000,000 gallons = 72,800 gallons per square mile for 2,747 square miles, representing at Teddington, for 3,766 square miles, 274,000,000 gallons. In 1887, Teddington gaugings were 17,96,000,000 gallons, and companies' takings 101,000 000 gallons, = 280,000,000 gallons. The discharge at Teddington is during dry seasons nearly always lowest on Mondays, because on nearly every reach of the upper river there are mills, which utilise the head of water held up by the weirs. Most of the mills work continuously day and night throughout the week, and the effect in dry weather is to draw down the level of the water from 1 ft. or 2 ft. below the Standard Head Water Mark. When they shut in at midnight on Saturday, the water in the upper reaches begins to rise, and until it has reached the Head Water Mark the downward flow is to a great extent intercepted. The effect of this is not felt at Teddington until Monday. Mr. Moore said that to some extent the discharge followed the rainfall; but it was difficult to follow. The number of days between maximum rainfall and maximum discharge varied a good deal, according to the season and the condition of the land when the rain fell. If the ground was already saturated the effect would be felt the same day. The Act said that a miller was to have as good a head of water as he had when it was passed. At the reach there is a Standard Head Water Mark up to which the water is kept, subject to the action of the mills. When they stop the water begin to rise. While it is rising the flow is intercepted to some extent, and the filling up of the reaches keeps the water away from Teddington. The mills are in almost every reach of the river above Windsor. The millers do not shut the weirs; that is done by the Conservancy's officers. In conclusion Mr. Mansergh said the Commission



Jennings's "Closet of the Century."

References.—A, Descending or long leg of syphon; B, Closet outlet or short leg of syphon; C, Air-inlet; D, Air-outlet or "puff-pipe"; E, Service-pipe from Cistern.

would meet Mr. Moore at the weir, and that would be better than talking about it in the room.

We are obliged to hold over until next week evidence as to the flow of the Lea, and evidence tendered on behalf of the County of Kent, Metropolitan Essex, the County of Surrey, the County of Middlesex, the County of Buckingham, and the County of Hertford, together with some statistics of population and supply.

NEW SANITARY APPLIANCES.

Mr. George Jennings, of Stangate, Lambeth, has just brought out a new and improved form of syphonic discharge water-closet (Jennings & Morley's patent). It is somewhat awkwardly named "The Closet of the Century," but it is much better than its name, as it has succeeded in solving the problem of having practically all the advantages of a valve-closet without the mechanism of that apparatus. As will be seen by the accompanying section, the basin holds a good body of water, 6 in. in depth, with a surface area of 12 in. by 10 in. The closet is syphonic in action, and has a seal of 3 in. of water, instead of the usual seal of about half that depth. The action of the closet will be made clear from the accompanying section. It will be seen that the down service-pipe E from the flushing cistern has two points of connection with the closet apparatus: one to the perforated rim, providing the ordinary supply to the basin for cleansing purposes; the other, introduced at the highest point of the descending outlet from the closet, being so arranged as to cause a natural syphonic action, which, in operation, withdraws the contents of the basin with all the velocity due to the atmospheric pressure upon the water surface. The socket D, formed in the outlet of the closet at the floor line, is intended for the introduction of a vent or escape-pipe for air displaced by the syphon jet in positions where the closet is fixed over a lead trap beneath the floor. This supplementary trap, it is explained, is in no way essential to the perfect action of the apparatus, but is suggested in deference to an opinion generally expressed as to the desirability of introducing a lead trap with plumber's joint between the closet apparatus and the soil-pipe. Where this secondary trap is not employed, a weir bend is substituted in order to ensure the effective action of the syphon discharge; the vent pipe is thereby rendered unnecesary, while a special form of coupling has been devised by means of which an air-tight connexion with the soil-pipe can be guaranteed.

Syphon closets are not altogether new. Mr. Jennings has held a patent somewhat on the lines described since 1886. A defect inherent in some forms of syphon closets has been their liability to become unsyphoned should a pail of slops be suddenly emptied therein, leaving the pan unsealed and dependent upon the rare individual intelligence of the servant to discharge the cistern and thus reseal the trap. Another objection has been to the rising of the water-level with the contents of basin before the syphon action is started; and the further difficulty of securing perfect syphonage in an outlet of adequate capacity to prevent stoppage, with the limited supply of water to which we are at present restricted by water companies' regulations. These objections, all of which seem to have been quite overcome in the present form, have hitherto proved fatal to the adoption of syphon closets. We have seen the "Closet of the Century" put to repeated tests which other syphonic-action closets have failed to withstand. The closet can be used with the regulation 2 gallon flushing-cistern, but with $2\frac{1}{2}$ gallons or 3 gallons better results are attained. The closet may be seen in action at Mr. Jennings's show-rooms.

The flushing-cistern of which a section is given is also Jennings & Morley's patent. It is divided into three compartments: in one a ball valve is provided, by which the apparatus receives water from the main or other source of supply. The water passes from the first compartment to the second by a passage through the bottom of the first compartment, and in connexion with this passage a valve is provided. The second compartment is of a capacity to contain the maximum quantity of water which it is desired to deliver at one action of the apparatus. This compartment has in the bottom a delivery passage of large area, and this also is provided with a valve. Immediately beneath the second compartment is the third compartment, and this is of a capacity to contain sufficient water for an after-flow. This third compartment is provided with an outlet valve immediately beneath the valve of the second compartment, and the lower valve has a passage of large area through it continued up to such a height that when the valve is on its seat the after-flow compartment can be filled. These valves are all closed by their own weight; they have rods connected with levers adapted to be acted upon by tappets upon an axis. The rod of the main delivery valve or that which allows the water to pass out from the second compartment is hollow, and the rod of the after-flow valve passes up through it. The axis before mentioned is partly rotated, when it is desired to bring the apparatus into action, by a pull-wire or other connexion, and afterwards a counter-weight causes it to return. The action of the apparatus is as follows:—When the axis is turned by the pull-wire or other connexion, the tappets first permit the valves in the first and third compartments to drop to their seats, so that now no more water can pass into the second or main flushing compartment of the apparatus, and the after-flow compartment is ready to retain water within it. Immediately afterwards the movement of the axis causes the main flushing-valve to be opened, and water rushes rapidly out of the main compartment. Some of the water passes down by the passage through the after-flow valve, and this forms the main flushing supply, whilst the remainder of the water missing this passage is retained in the after-flow compartment. On the pull wire or other connexion being released the axis returns to its original position, the after-flow valve then lifts, allowing the after-flow water to pass away, so that (the apparatus being used in connexion with a water-closet) the after-flow water enters the pan after the pan-valve has closed, and it there remains. During the return of the axis also the main flushing-valve closes, and the valve by which the second compartment fills opens, and allows water to pass into it from the first compartment, to which a further supply comes from the main.

ARCHÆOLOGICAL SOCIETIES.

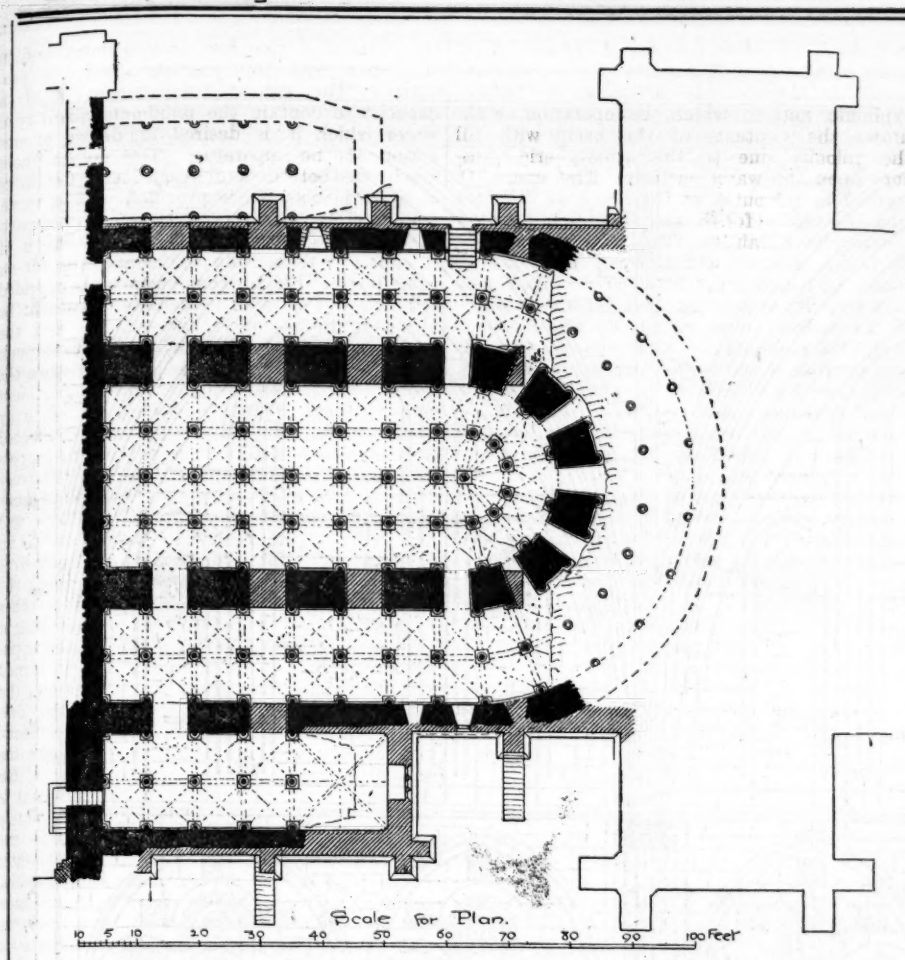
Cambrian Archæological Association.—The forty-seventh annual meeting of this Association is to be held next week at Llandeilo-Fawr, Carmarthenshire. It will commence on Monday and will be continued on the four following days. Among the places to be visited in the course of the excursions are Talley Abbey, Castell Carreg, Carn Goch, and Llandovery.

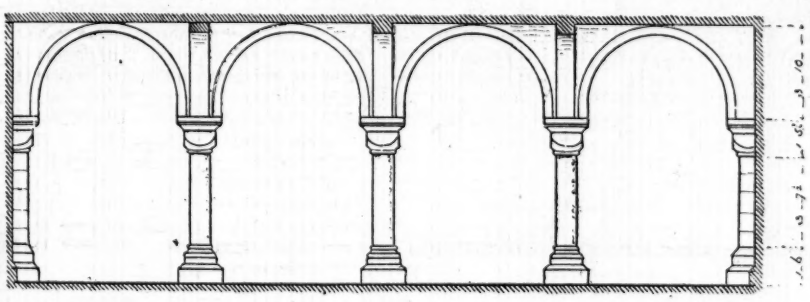
Royal Archæological Institute.—The annual congress of this Institute commences on Tuesday next, at Cambridge.

British Archæological Association.—The forty-ninth annual congress of this Association is to be held at Cardiff this year, from Monday, August 22, to Saturday, August 27. The programme of places to be visited and of papers to be read is full and varied.

Kent Archæological Society.—The annual meeting of this Society was held at Dover a few days since. The thirty-fifth annual report, which was adopted, stated that the Society was still in a prosperous state. During the year the Society had lost by death and other causes many old and valued members, but their places had been filled by new members. Twenty-one new members had been elected during the past year, while several were awaiting election. Reference was also made to the retirement of Canon Scott Robertson from the editorship of *Archæologia Cantiana*, and it was also stated that the Rev. Canon Routledge had kindly undertaken the duties of honorary editor. The financial position was such as left nothing to be desired, the balance in hand at the present time amounting to 800*l.* 9s. 5d.

Incorporated Association of Municipal and County Engineers.—We are obliged to hold over until next week the continuation of our report of the Bury meeting of this Association.





Worcester Cathedral: Plan and Part Section of Crypt. Measured and Drawn by Mr. Harold Brakspear.

Illustrations.

WORCESTER CATHEDRAL.*

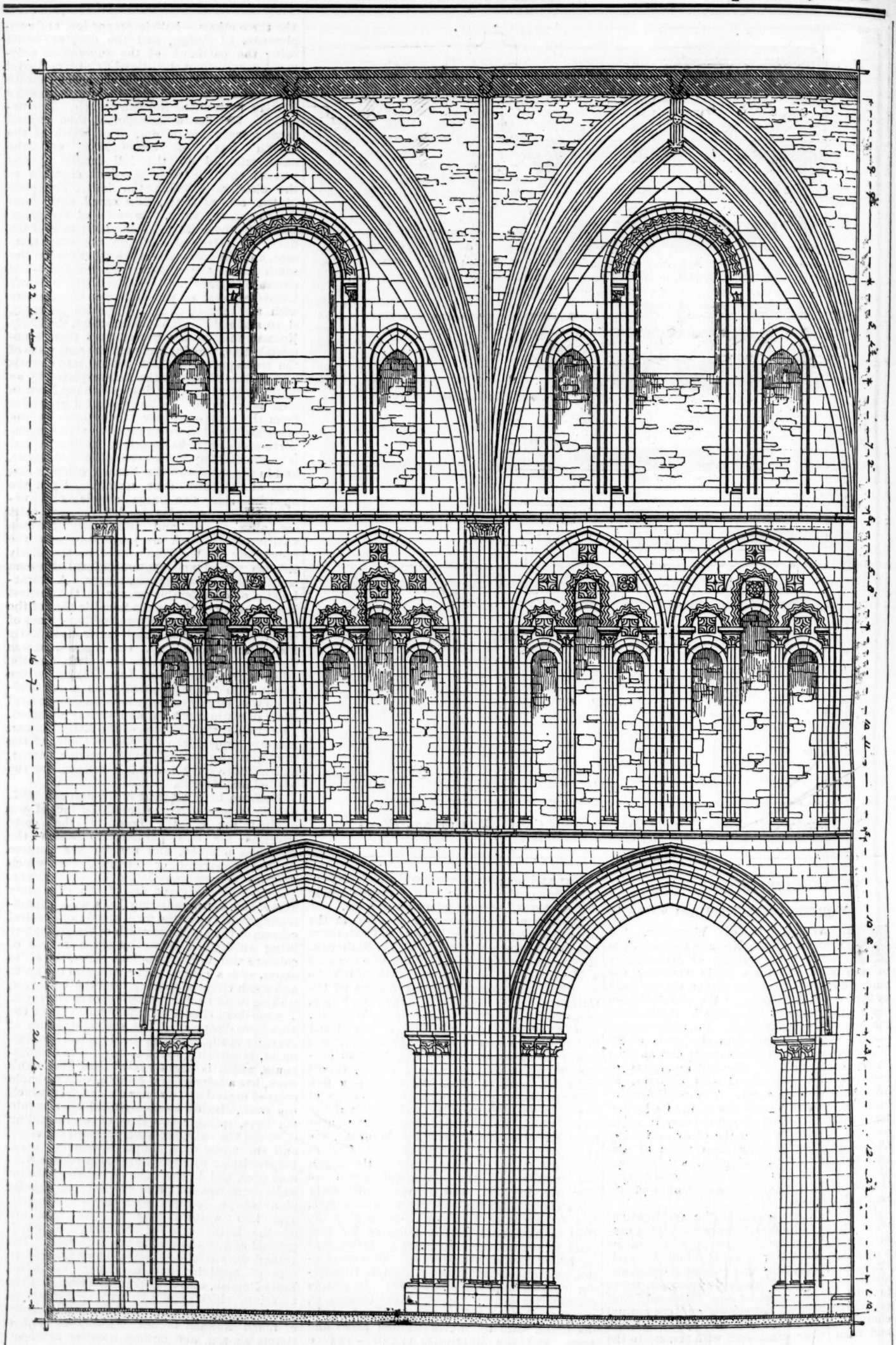
ST. WOLFSTAN of Worcester, the founder of the Norman Cathedral, is recorded by William of Malmesbury to have burst into tears while watching the pulling down of the earlier Saxon church built by St. Oswald, exclaiming, "We wretched ones destroy the works of the saints." Apart from the question of inferiority in architectural design, which did not form the basis of St. Wolfstan's regret, his words might find an echo in the consciences of cathedral architects of our own day, professional and amateur, at Worcester and elsewhere. The rebuilding of both the east and west fronts of the Cathedral, for the mere purpose of consistency in style, and the abrogation from the choir and Lady Chapel of later features than those of the ordained period of Early English, as "debased," as well as the demolition of the magnificent Guesten Hall, form a record sufficient to justify reasonable regret.

It, however, says much for the architectural value of the Cathedral, besides qualifying censure upon its restorers, that it still remains a building of marked beauty and interest. Professor Willis, who was carefully optimistic about the doings of his contemporaries, wrote in 1863, before the choir was "restored," that of "Great English cathedrals and conventual churches it is inferior to very few in interest and value, when considered with respect to the history and practice of mediæval architecture;" and, adding the words "and of restoration in modern times," we may adopt his opinion.

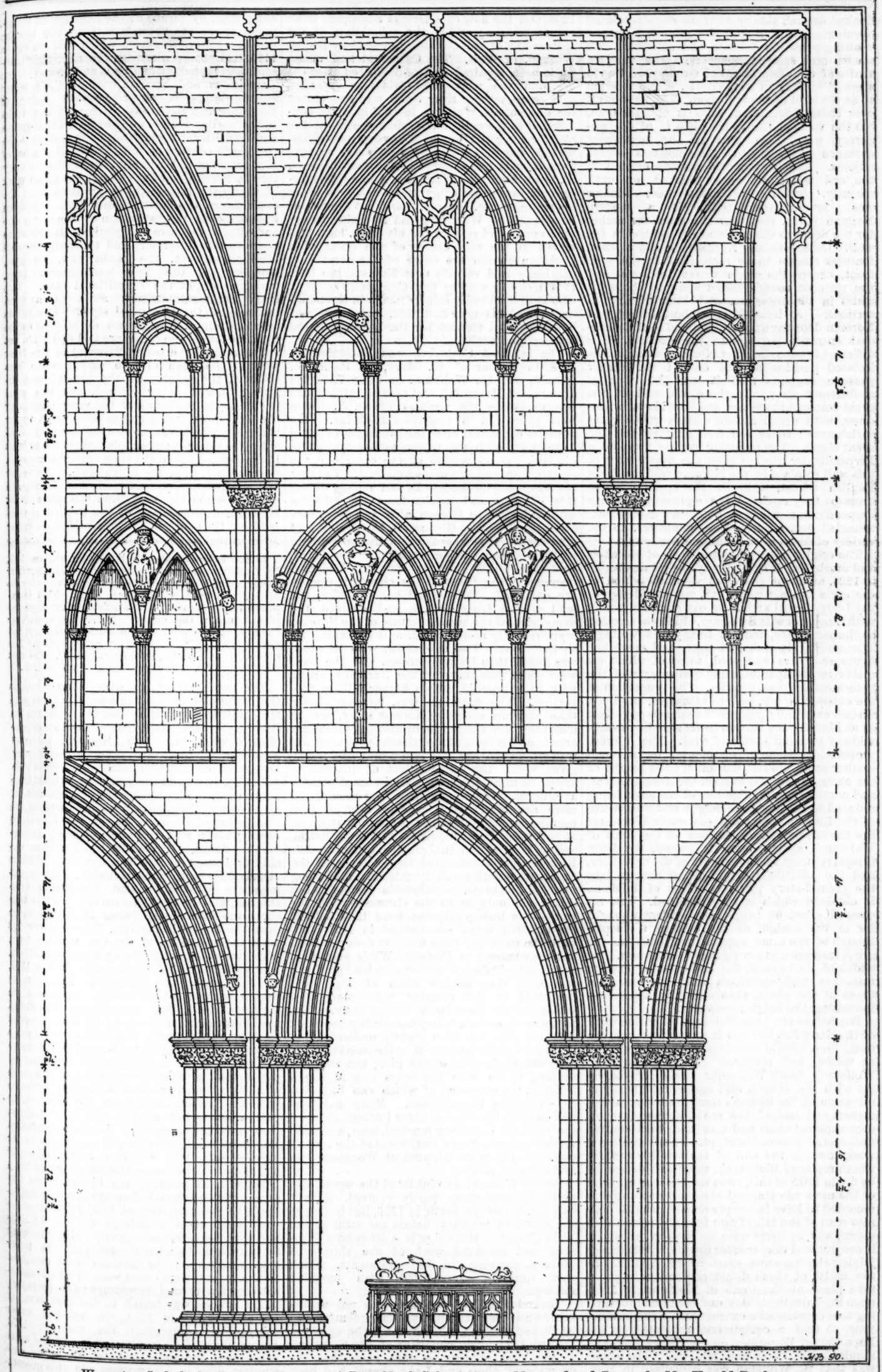
The See of Worcester was founded in the seventh century, and St. Dunstan of Canterbury was among the early holders of the bishopric. He was succeeded by St. Oswald, who founded a Monastery of Benedictines, into which he absorbed the original secular canons of the Cathedral, and erected the Church of the Virgin, removed for a grander edifice by St. Wolfstan. The latter saint was the last of the Saxon bishops, and a man of sufficient character and power to be recognised by the Norman conquerors, whose two kings he faithfully served until his death in 1095. An interesting link with the Saxon church exists in the design of the balluster columns of the wall arcade of the slype, which, if not themselves relics re-used from St. Oswald's Church by Wolfstan, are of marked Saxon character and distinct from the other Norman work. He began the erection of the Cathedral which we now see in 1084, and it was sufficiently advanced in 1088 for the monks to enter into. In a document of Wolfstan's, dated May 20, 1089, he incidentally reveals some of the first principles of mediæval architects in stating that he added to the monastery by "the construction and ornamentation of a church ("ecclesiæ constructione et ornatione"). In simple constructive beauty apart from ornaments, which at that period were archaic and crude, the crypt, with its twelve vaulted aisles and apses, and the impressive circular-vaulted chapter-house of his immediate successors, which remain to us, are unrivalled; the crypt being the most perfect of the four Norman ones,—Winchester, Gloucester, and Canterbury, are the three others,—both in proportion, and completeness of design, and the chapter-house being the patriarch of the subsequent polygonal ones so characteristic of English mediæval design. The crypt occupies the space beneath the present choir, and with its apse defines the Eastern limit of the Norman church. It is uncertain whether a lady-chapel then existed further eastwards or not. The width of the church was not varied later, and the nave extended to the full length of the present church, the south-west entrance to the cloisters marking the limit. The piers of the central tower, now cased with fourteenth century work, the walls of the great transepts, the north and south aisle walls of the nave, the slype abutting on the south transept, and the basement of the refectory on the south side of the cloister, with the south-east entrance adjoining, all indicate that Wolfstan's Cathedral, west of the choir, was co-extensive with the present church. Besides the crypt, slype, and undercroft of the refectory, the Early Norman remains are fragmentary though unmistakeable, two fine arches in the east walls of the transepts exist, which opened into chapels now destroyed, that on the south replaced by an Early English building, into which the Norman arch now opens. An Early capital protrudes from the south-east pier of the tower in the choir aisle, and Norman masonry shows in the north-east pier in the triforium. Another capital is in the east bay of the north aisle of the nave, and in the same wall the Norman columns and caps of the north door remain. Upon the opposite side five large simple and unmoulded semi-circular headed recesses exist for altar tombs, and two Early Norman vaulting shafts mark the junction between the re-building of Wolfstan's nave in the Early English period and the transitional Norman work of the two westernmost bays. A characteristic of considerable beauty in the earliest Norman work, which is not found in that of the later period, is the use of two building-stones of varied colours in horizontal bands, as in Early Italian marble masonry. One stone used was the creamy-coloured oolite from Bath, and the other a grey-green stone from Higley, on the Severn. In the subsequent work a red sandstone was largely employed, and a fine general effect of warmth of tone and variety obtained. Two circular stair turrets, of the Early Norman masonry, project into the western angles of the transepts in an unusual but picturesque manner, and afford a very favourable surface for the banded masonry.

Wolfstan held a synod in the crypt in 1092, and it is interesting to recall the fact of the original use of the apse in the early basilicas for this purpose, to which the plan was adapted, and not for the purpose of the sacrarium or chancel, for which it offers no accommodation or convenience. The apse of the crypt, and of the presbytery above, had seven radiating bays, with concentrating vaults upon the inner arcade and central column of the crypt, the width of the presbytery being subdivided below by three ranges of columns and vaults into four aisles, the aisles above, with a central range, and also the north and south chapels opening from the transepts, making in all twelve vaulted aisles in the crypt. The northern chapel and the outer aisles of the apse have disappeared, but the construction of the early vaults, as also in the slype and chapter-house, is perfectly sound to-day. The chapter-house, which is slightly later than Wolfstan's work, has a lofty central column, with a simple splayed capital and circular abacus, from which the vault, divided by boldly-moulded ribs into ten bays, springs; two tiers of wall-arcading surround the walls, the lower recessed for seats, and the upper of a simple interlacing type. Perpendicular windows have replaced the Norman ones, and in the same period the exterior walls were squared from the Norman circular plan into a decagon with angle buttresses. The two western bays of the nave are of the latest type of Norman, in which pointed and round arches are both used. The ground story is almost sufficiently advanced in type of moulding and carving to be called Early English, with fully pointed arches, but the triforium which is of two bays, within severe pointed enclosing arches, encloses small arcades of round Norman arches, ornamented with a simple zig-zag, and curious rosettes arranged upon the tympanums. The clearstory also divides the round and pointed styles without mingling them, it consisting of a central wide round-arched opening, with Norman ornaments

* This series of illustrations of the Cathedrals of England and Wales was begun in our issue of January 3, 1891. A list of those already illustrated, with particulars of future arrangements, will be found on page 118.



Worcester Cathedral: Interior Elevation of Two Western Bays of Nave. Measured and Drawn by Mr. Harold Brakspear.



Worcester Cathedral: Interior Elevation of Bay, North Side of Nave. Measured and Drawn by Mr. Harold Brakspear.

flanked on each side by a narrow steeply-pointed opening. The shafts of the ground story and vaulting piers are delicate, and clustered, with square and splayed abacuses. The vaulting shafts of the easternmost of two bays rest upon the earlier Norman banded pier, before referred to at the level of the triforium. The nave vault over these Transitional bays is of later date, but the vault of the south aisle is of contemporary work, also that to the south-west entrance passage to the cloisters which adjoins. Three western doorways existed in the end wall; all were blocked up until recently, when the great west window was erected, and with it a modern Norman portal made for the nave, the arches for the doors to the aisles are traceable in the wall. Otherwise no Norman or Transitional features remain to be recognised in the west front, except the angle turret buttresses and the restored round-headed windows above the aisles in the triforium, with later tracery insertions. A beautifully-elaborated pointed Norman doorway exists unrestored to the south-east entrance passage to the cloisters, of a different type to the other Norman work, and its isolated position at the end of the earlier passage suggests that it was the work of a different time. In the south wall of the great transept there are fine late Norman windows, with round arches with a bold zig-zag enrichment; these are now obscured by the great organ. The restoring purists removed a Perpendicular window from the upper story of this wall to place in the Norman wall an Early English triplet, while in the opposite north transept they replaced the eighteenth-century Perpendicular window with a geometrical traceried one, a concession, doubtless, to the variety of dates in the removed windows.

The original Early English work of the choir and presbytery is exceedingly fine; it was begun in 1224, at about the most vigorous period of the style as a native growth, and the design of the Lady Chapel and choir can compare boldly with Lincoln or with Salisbury, which was erecting at the same date, and not to any disadvantage. The carving is rich and pure, and much fine figure sculpture was used, some of which remains in the spandrels and tympanums of the triforiums and wall arcades. The proportion of the extended choir, eastern transepts, and Lady Chapel externally produce the same happy effect as at Lincoln, the lantern tower standing nearly midway between east and west. The internal proportions, though, of course, on a much smaller scale, are not dissimilar; the height of the choir, raised as it is upon the Norman crypt, and continuing the ridge line of the nave, being reduced to the moderate height and full width of the Lincoln choir; but eastwards Worcester has the advantage, for, as soon as the limit of Wolfstan's apsidal crypt is passed, the Lady Chapel resumes the lower level of the nave floor, and the additional height being thrown into the ground-story piers, an effect of loftiness is obtained which is very dignified. This increased effect of height was evidently sought for in the design, as the eastern transepts, though of the same approximate height as the great transepts, are considerably narrower. The width of the bays in the Lady Chapel eastern transepts and sacrarium are also less than those of the choir, thus aiding in apparently increasing the height eastwards.

But before the beautiful and extensive work of the Early English epoch was undertaken, the usual fires, falls of towers, and wonders worked at tombs, had occurred. Eight years after Wolfstan's death Worcester was destroyed by fire with the church and castle, and the preservation of the bishop's tomb from the falling embers and lead of the roofs, shows that his contemplated choir and apse had been erected and roofed in over the crypt. The Transitional work towards the end of the twelfth century which replaced Wolfstan's was itself destroyed by fire in 1202, of this, however, the western bays of the nave remain, and the then new tower is recorded to have fallen previously in 1175. We also read of the fall of two towers besides, in a storm, and, as there were no western towers, it is conjectured that smaller towers or turrets adjoining the transepts must be referred to. In the midst of these disasters wonders began to take place at the tomb of Wolfstan in 1201, upon St. Valentine's Day, and continued increasing to a considerable extent during the ensuing year, so that a commission appointed by the Pope visited Worcester on St. Giles's Day, and inquired into them and reported. The result was that St. Wolfstan was canonised in May, 1203, and the flow of offerings continued to an extent which justified the rebuilding of the eastern end of the Cathedral in 1224 by Bishop William, of Blois. The Cathedral had meanwhile been repaired and re-dedicated after the fire, and the works had evidently extended over some years. King John, who had visited the tomb of St. Wolfstan in 1207 in State, contributed to the cost of the reinstatement of the cloister after the fire of five years previously, he had died in 1216, and his body was brought from Newark and interred in the choir between St. Oswald and St. Wolfstan. A fine sixteenth-century decorated effigy and tomb now mark his resting-place, and one fears that the favour he showed to Worcester and its Saint, rather than even blind respect for his office, have preserved in the very centre of the choir of a Christian church the effigy of the worst king politically and morally that England has had. It is indeed a wonder that Cromwell's soldiers, who mutilated every saintly image in the building, spared his nose and face, perhaps he was left in cynical respect for the memory of the departed monarchy.

The repaired Cathedral was dedicated in 1218, in honour of St. Mary, St. Peter, St. Oswald, and St. Wolfstan, on June 7, in the presence of Henry III. and many distinguished persons, when the remains of St. Wolfstan were placed in a magnificent shrine. The miracles continued after the interment of King John, and, with the undoubted sympathy of his son, the re-erection of the choir and the eastward extension was commenced. The best use was made by the monks and bishop of the tide of gifts and profits from the miracles while it lasted, as it soon after began to flow down the Severn to Gloucester, to the shrine of Edward II. It is recorded that Bishop William of Blois begun the new work of "the front." Professor Willis remarks that in Mediæval documents the front of the church is usually the east end. This would be, therefore, the wall of the Lady Chapel, and involved the demolition of the superstructure of the Norman crypt recently re-dedicated, and extending up to the tower. The new choir, with its vault, was loftier than its predecessor, and the bays were wider than those of the Normans, rising with their pointed arches higher still in proportion. The triforium was, however, lower than the corresponding Norman story, but the clearstory was similar in height. A secondary arcade at the back of the triforium, against the wall which encloses the space over the aisles, gives much the same effect of interlacing arches as in St. Hugh's much-discussed arcades at Lincoln. The shafts clustering around the piers are of Purbeck marble, now of that peculiar colour produced by ill-directed attempts at polishing. They are jointed with metal bands, and as it is stated in Leland's Itinerary that Bishop Giffart decorated the columns of the east portion with small marble columns having joints of gilt brass, considerable discussion has arisen not only as to the chronology of the work,—the bishop reigning from 1269 to 1302, the building being commenced in 1224,—but as to the rings and their use. It does not seem to have occurred to Professor Willis even that the marble shafts are bedded with lead seatings, and that this narrow seam of lead was decorated by the rounded brass ring with which we are familiar at Westminster. The presence of an iron cramp connecting the shaft with the pier has been rightly understood as provided for the purpose of attaching the shaft after the settlement of the pier; but this has nothing to do with the brass ring and lead bedding, the existence of which can be tested by scratching the surfaces. Many instances will occur to the mind of these Purbeck grouped shafts which have been crushed, bent, and split vertically owing to the settlement of the central pier, but the plan adopted at Worcester has avoided such results.

Bishop William, who initiated the works, and probably saw them partly vaulted, if not entirely, before his death in 1236, lies buried in the middle of his work, before the altar of the Lady Chapel. His effigy is a singularly complete and beautiful work of the thirteenth century, showing the full vestments, which were formerly ornamented with jewelled settings.

The rebuilding of the nave was not undertaken until the next century, it being commenced by Bishop Cobham, who occupied the see from 1317 to 1327. The condition of the Cathedral at this time appears to have been that the magnificent choir and Lady chapel had been completed, by means of the pilgrims' offerings, much as we see them now, that the twelfth century tower, however, which fell down in 1175, had not been rebuilt, the adjoining transepts had been damaged by it and now evidence Transitional and Norman work in their lower stories only, the upper portions being of Perpendicular date, without connecting links to the earlier period, and the nave of Norman and Transitional work. We find that so late in the thirteenth century as 1281, Bishop Nicholas, of Ely, formerly of Worcester, bequeaths a legacy for the rebuilding of the tower, but as no work of that date remains, it is probable that the expenditure was deferred until Bishop Cobham undertook the reconstruction of the north side and aisle of the nave completely. He lived to complete the clearstory and to vault the side aisle throughout, the main wall, however, stopping at the two westernmost bays, which he left, of the Transitional nave. This early fourteenth-century work is a good example of the Decorated style. The shafts and mouldings, though not so bold as in the earlier work of the choir, are full and rich, not suffering from the over refinement of the later work. The plan of the earlier nave was adopted, the heights of the ground and triforium stories being altered, but the total height to the springing of the vault remaining the same; springing-stones were built in for the vault, which was not added for some considerable time; a rectangular chapel was built in the second bay of the aisle from the transept, and vaulted with the north aisle. Professor Willis gives a summary of the fourteenth century works obtained from the notes of Dr. Hopkins, a prebendary of the Cathedral from 1675 to 1700, which he found in the Baker MSS. in the Harleian Collection, as follows:—

1320. Prior Braunston built the gesten hall. 1372. Refectory and cloyster built. 1374. Tower or belfry. 1376. Stone vault over the quire under the belfry, and over St. Thomas' altar. This is explained by the fact that the quire at that time was placed under the belfry. 1377. The vault over the nave of the church, the library, treasury, and dormitory. 1378. The water gate. 1379. The infirmary and stalls in the quire. 1380. The west window. 1380. The north porch of the church.

The north wall of the nave being rebuilt in the early part of the fourteenth century, and the south wall and vault not being undertaken till fifty years after, the condition of the church with one side Norman, the end Transitional, and the other side of new Decorated construction, can be imagined with difficulty, as a temporary roof only could have been used. The slackening of the tide of pilgrims and their gifts probably hastened the completion of the nave, as the late fourteenth century south wall and aisle, of Early Perpendicular detail, do not display the care and skill or beauty of the Northern wall, which it closely follows in general design. The mouldings are attenuated, and the shafts over-thinned, and scrapy little carved capitals take the place of the rich bands of foliage which make the Decorated capitals. The vault, perhaps with the exception of the two western bays, which were the work of Bishop Wakefield 1375-94, was built by Abbot Horton, who died in 1377, and is ingenious and beautiful. The unity of design secured at Worcester is unusual in Mediæval work, the Transitional, Decorated, and Perpendicular portions all come together as harmonious parts, well connected into a whole by the vault; there is no definite breach of intention or contemptuous ignoring of earlier work so often seen elsewhere. As much of each period is retained as possible, probably not only out of respect for the work of the patron saint, but also, in the later portion, from motives of economy. It also appears that the works were never wholly given up to the unrestrained will of one individual; the existence of the large monastery acted as a balance to the power of the bishop, as we find agreements between bishop and convent respectively for the execution of fixed portions of the work in the cases of Bishops William of Blois and Cobham. Simultaneously with the work in the nave the reconstruction of the tower was undertaken; the Norman piers remained as a core, and were cased with the fourteenth-century shafts and mouldings; the springing of the arches was raised to the new level of the nave vault in 1374, the vaulting under the belfry completing the work in 1376. Bishop Wakefield's work remains in the north porch and the inner arch of the great west window, filled in a few years ago with geomet-

rical tracery inconsistent in style with everything in the Cathedral, and he was buried under the two bays of his vault at the west end.

Of later Perpendicular work there remains the very fine chantry of Prince Arthur, son of Henry VII., on the south side of the choir, an interesting example of the early development of the traceried vaulting that so rapidly attained the beauty exemplified in his father's later chapel at Westminster. Perpendicular tracery was freely inserted in the earlier windows. The principal internal work, however, was the vaulting and decoration of the great transepts. The walls above the ground stories, which are of Norman, were panelled with an early cusped treatment, with mullions and transomes that form strings and vaulting ribs, and are an early attempt at a complete panelling of the wall surface, which later became prevalent, as at Canterbury and Gloucester.

The cloisters, now completely restored, are of this period. The vaulting is boldly moulded with finely-carved bosses. It springs from the south wall of the nave, without any relation to the buttresses which mark the internal vaulting bays. The piers on the inner walls around three sides of the garth have square openings in them, somewhat of the character of a continuous hagioscope. The chapter-house had windows inserted and a new face given to it at this time. A most interesting series of apartments between the chapter-house and the south transept also belong to this period; they are the treasurer's chambers, and have a communicating passage to the south-east chapel of the choir. They are roofed with a flat four-centred vault, and have a vaulted gallery leading to other smaller chambers, perhaps used as dungeons. Upon the opposite side of the church, in the north choir aisle, is a picturesque oriel window of similar date, projecting from the outer wall as a watching-loft. This must have been reached from the chamber over the north-east chapel now destroyed, and was used by the sacrist or watching friars. There are also evidences that the large room over the north porch was used as a dwelling in connection with the Cathedral. The triforium gallery over the south aisle is now used as the Cathedral library, the books being recently removed there again from the chapter-house. It is lighted by Perpendicular windows above the south aisle.

A finely-moulded stone Perpendicular screen, a fragment of which has been preserved, is fixed in the arch opening to the choir from the south transept. The pulpit in the choir was erected there in 1748, but is of Perpendicular date, and was formerly in the nave.

Reformation times and Worcester will always be connected with the great Bishop Latimer, the most vigorous reformer and eloquent preacher of his time. In his day there was a "fair stone cross in the churchyard, which was the usual preaching place, as at St. Paul's, London. There were also seats for the chief of the city on the north side of the church, but south from the cross, much resembling those of St. Paul's." There is no memorial of Latimer in the Cathedral, or indeed anything but the name of the place and See to remind us of him; but his fame will not suffer by this neglect.

The choir seats and stalls of 1379 were removed from under the tower to the presbytery, their present position, about 1537, on the establishment of a Dean and Chapter, and Renaissance canopies placed over them at a latter period. These remained when Professor Willis wrote in 1862 that they "are valuable specimens of woodwork," they were however removed at the "Restoration" of the choir, and nothing put in their place. The Cathedral suffered much damage after the battle of Worcester at the hands of Cromwell's soldiers, and substantial repairs were made in 1712, partly at the cost of the Government, to replace the damage. At this time a buttressing wall was erected across the north-east transept to prevent the piers of the choir from falling, and the wall was pierced with four quatrefoils of bold design.

The great north transept wall was rebuilt in 1748, with a Perpendicular window of the period and turrets, by a local architect, Mr. Wilkinson, who erected St. Andrew's, Worcester, and displayed a tendency to the most attenuated form of spire and pinnacles. Successive alterations were made to the east and west windows. In 1812 a new altar screen was erected, and finally, in 1857, extensive restorations were undertaken, under the late Mr. Perkins of Worcester, and Sir Gilbert Scott was called in to design the "Restoration" of the choir. Of all this work, and the elaborate reredos, it is exceedingly difficult to speak even descriptively. One has a lingering fear that the enthusiasm with which it was regarded twenty years ago has already changed to dislike, and fearing lest this feeling should also prove ephemeral, it may be better to leave the modern work at work at Worcester to the tender mercies of the next generation, who may safely regard it as the *ne plus ultra* of Liberal "Conservative Restoration."

STAFFORDSHIRE COUNTY COUNCIL BUILDINGS.

We give the principal elevation and plans of the design, by Mr. H. T. Hare, which has been selected in competifion for the new County Council buildings at Stafford; also the drawing showing the detail of the Council-room, and a perspective sketch of a portion of the intended building, executed after the competition designs were sent in. The whole of the designs submitted are still at Stafford, and will be exhibited in the Shire Hall there next week, when we shall have an opportunity of reviewing them generally. We have selected these drawings of the accepted design, after consultation with Mr. Hare, as those which best represent the treatment of the building. Owing to the presence of existing buildings on the site, one of which is partially worked into the new building, the other elevations are not architecturally important.

The following quotations from the architect's draft report, which he has placed in our hands, will give sufficient information as to the general scheme and treatment of the design:—

"The suggested arrangement of the departments has been adopted,—that is, the Council-hall and committee-rooms are on the first floor, and the offices on the ground floor beneath them. The principal difficulty which presents itself in the consideration of the plan is that, owing to the main entrance being at the end of the long narrow site, it is apparently a necessity that there should be a long corridor for access to the rooms on the first floor. This difficulty the author has endeavoured to obviate by the arrangement of the entrance-hall and staircase on an axis at right angles with St. Martin's-place. The effect of this is that the head of the staircase leads immediately into a central ante-room, with which the Council-hall and committee-rooms communicate, only a very short length of corridor being required, and this is treated in such a manner as to become practically a part of the ante-room.

The main entrance has been kept as far as possible towards the market square, the loggia to the Judge's house being continued to form a recessed porch. The treatment of this portion of the front being restricted to the ground-floor story, the author is of opinion that any attempt to deal with it more elaborately than the existing arcade would be detrimental to the effect of the whole. The alterations suggested to the ground floor involve no serious structural operations, and the accommodation provided comprises waiting-room, cloak-room, and porter's lodge.

The entrance-hall is 40 ft. 6 in. by 21 ft. 6 in., and 12 ft. 6 in. high, this latter dimension being fixed by the height of the existing story. An increased effect of height is, however, obtained by the introduction of a central dome, which is behind the existing buildings, and from which the hall is lighted. . . .

The ante-room on the first floor is top-lighted, and is designed with a groined ceiling in plaster, which would afford a field for an effective scheme of colour decoration.

The Council-hall is entered from the ante-room by two doorways. The general form of the apartment is a square, of which the side is 39 ft. The seating is arranged in tiers to a circular sweep, the centre from which the circle is struck being the chairman's seat. The two gangways are kept as far as possible to the sides, so that the division of the Council into parties or sides would be a practical impossibility. The author is of opinion that the acoustic properties of the hall would be eminently satisfactory, and no other arrangement of seating would give the requisite amount of accommodation at so small a loss of space. The hall is amply lighted from windows placed high up, which would give a more pleasing effect than any form of roof lighting.

The entrance to the offices is from Martin-street, and leads into an entrance hall from which the corridor runs right and left. The departments are so placed that the inquiry office of each is entered from the hall. By this arrangement the public would not require to use the corridors, which are screened from the hall, and would thus become practically private to the officials.

The author has made a personal examination of the site and existing buildings, and finds that it is not possible to make a connexion between the new and the existing buildings on the ground floor without seriously interfering with the Judge's house, and even if this were done, it is very questionable whether the communication would be of any practical value. The loggia at the entrance will, however, form a connection under cover. The suggested communication on the first floor is obtained at the only available point, by a corridor running from the main staircase. A w.c. and lavatory are provided to take the place of those removed.

Provision is made in the basement for heating apparatus and electric lighting plant.

Materials and Construction.

The front elevation is proposed to be faced with stone up to the level of the first floor, similar to that used in the existing buildings. The upper portion of the front to be faced with best red facing bricks, with stone dressings, strings, &c. The back elevations to be entirely in brick.

The whole of the floors to be of fireproof construction in steel and cement concrete. The flat roof to be constructed in a similar manner, and covered with Seyssel asphalte 1 in. thick laid to falls.

The roofs of main buildings to have wrought-iron principals, with timber purlins, boarding and felt, and covered with 14 in. by 18 in. Whitland Abbey slates, fastened with copper nails to a 3 in. lap.

The turrets to be covered with copper.

The floors of the main entrance, entrance-hall, ante-room, and ground-floor corridor, to be paved with black and white marble tiles in 12 in. squares. The floors in offices to be of 1½ in. keyed pitch-pine blocks. The floors in Council-hall, committee-rooms, &c., to be of 1¼ in. teak blocks, wax polished.

The main staircase to be in Hopton Wood stone, and the official and public staircases in rubbed York stone.

The walls in entrance-hall to have a panelled teak dado, and above to be lined with polished Hopton Wood stone. The walls of the main staircase to be lined with Hopton Wood stone up to the height of the string-course, and above finished in plaster for colour decoration. This treatment would be continued in the ante-room, corridor, &c.

The walls in the Council-hall and committee-rooms to have teak panelled dadoes, and to be finished above in plaster.

The pilasters and columns in Council-hall and entrance to be in polished Devonshire marble.

The whole of the doors and other joinery on the first floor to be in teak, and the seats and other fittings in the Council-hall in the same material, upholstered in dark green leather.

The walls in the offices, &c., to be finished in plaster and painted in oils.

The windows to be glazed with polished plate-glass throughout, except in the Council-hall and main staircase, where it is suggested that lead glazing be introduced, and possibly replaced at some future time by painted glass. The glazing of the upper panels of the doors to offices to be in double muffled glass.

The ceilings to Council-hall, committee-rooms, &c., to be executed in fibrous plaster, enriched as suggested on the drawings.

Heating and Ventilation.

The offices, committee-rooms, &c., are provided with open fireplaces.

The heating of the other portions of the building is proposed to be effected by low-pressure steam, with radiators in entrance-halls, corridors, &c. In the case of the Council-hall a powerful steam coil is placed in the basement, and fresh air is drawn from the outside, filtered, and passed over the coil, by a 4 ft. cased fan, driven by a gas engine. After being heated it is conducted to convenient points of outlet by flues. The apparatus would also be available for cooling the room in hot weather.

Inlet ventilation would be provided for in all the offices, committee-rooms, &c., by Tobin's tubes.

Extractors are placed in the roofs over the Council-hall and committee-rooms, and the up-current would also be assisted by small steam coils placed in the shafts. Each office would be provided with a special extract-flue running up beside the smoke-flue.

Architectural Treatment.

This is somewhat restricted by the existing buildings and the fact that the main frontage is in an unimportant thoroughfare. The style the author has adopted is the English Renaissance of the seventeenth century, which is in harmony with the existing buildings.

The elevation to Martin-street is of simple character, but the author has endeavoured to impart to it some dignity and expression. The upper portion is faced with brick with stone dressings, as the street scarcely seems to warrant an entirely stone-faced building. This, however, is no essential part of the design, and if considered desirable, stone could be used throughout without affecting it in any other way.

The elevation towards Eastgate-street is treated

somewhat in a similar manner to the adjoining Eastgate House."

The cost of the building is estimated by the author as 17,477*l.*

COMPETITIONS.

Proposed Extension of the Manchester Royal Infirmary. — A special general meeting of the Trustees of the Manchester Royal Infirmary was held on the 27th ult., in the Memorial Hall, Albert-square, Manchester, to consider the proposal of the Board of Management to extend the Infirmary buildings on the site in Piccadilly. The report of the sub-committee of the Board of Management, nominated on February 17, to consider plans for an extension of the Infirmary consistent with its possible future construction was taken as read. The sub-committee stated that five meetings were held, at which three sets of plans submitted for competition received careful scrutiny, with the view to determine their several merits, their relative adaptability for furthering the best interests of the institution, their general features in respect of harmonising with existing surroundings, and in their entirety as tending to form an additional ornament to the city. The prescribed requirements had been complied with by each competing architect. Different methods, however, having been followed in working out details, the committee had had to give careful consideration to each plan with regard to its suitability to the uses intended. Two of the three competing architects had selected the Piccadilly frontage as the one best adapted for carrying out an extension. In this conclusion the sub-committee fully concurred. The sub-committee had further determined that, if the requisite extension could be effected by a three-storied elevation, such would be preferable to the addition of a fourth story. They were of opinion that each new ward should be built on the "pavilion" principle, and that any scheme calculated to provide four rows of beds in a ward, divided by an intervening screen, would be open to sanitary and other objections which do not apply to wards constructed on the recognised method of placing two rows of beds opposite one another against the outer walls. The sub-committee had carefully weighed the respective advantages of adopting circular wards as against longitudinal wards, and, without attempting to dogmatise on a question that has enlisted advocates and architects on either side, they had concluded that, —allowing each system to have compensating merits,—the construction of circular wards would be so much out of harmony with the present building as to make their adoption an incongruity. The sub-committee recommend the plans,—subject to minor changes in detail,—of Mr. Alexander Graham, which, in their judgment, offered the largest advantages architecturally, with the fewest countervailing drawbacks; and they were satisfied that if their carefully considered opinions and suggestions were adopted, Manchester would find itself possessed of an infirmary second to none in outward architectural effect and in internal efficiency. In the matter of cost, Mr. Graham submitted the following estimates:—(1) Two new wings, new operating theatre, and sundry structural and other alterations of the main building, as shown on the several amended plans, 34,000*l.*; (2) extension of the nurses' home, as shown on the plans of December, 1891, including sanitary fittings, 5,020*l.*; (3) extension of out-patients' department, and alterations thereto, 1,700*l.*; total, 40,720*l.* If the suggestions of the Committee were carried out, the increased area built upon would represent less than one-third of an acre, and the whole space then covered will be less than 1½ acre, leaving about 3½ acres still uncovered.—The Chairman, Mr. E. S. Heywood, submitted the following resolution:—"To receive and consider, and, if approved, to adopt the report of the Board of Management upon the architect's plan for the proposed extension of the Infirmary on its present site."—Dr. Renaud seconded.—Sir W. H. Houldsworth, M.P., moved as an amendment, "That the trustees are of opinion that whilst it is manifestly important that the Infirmary should be retained on its present site in the utmost state of efficiency, any extension of the accommodation thereon is very undesirable." — Dr. Leech seconded. — The amendment on being put to the meeting was carried.—Mr. Platt Higgins, on behalf of the Board of Management, thereupon demanded a poll, which will be taken next week.

Proposed Town Hall, Walsall. — We are informed by the Town Clerk that the Committee, after careful consideration of the thirty-nine designs sent in in the preliminary competition, have awarded the two premiums as follows: 1st, to Mr. John R. Withers, Shrewsbury; 2nd, to Mr. Daniel Arkell, Birmingham. It is added that as from the designs sent in it is clear that a hall sufficient to meet the requirements of the town can be erected on the suggested site, it is the intention of the Committee to recommend the Council to offer in competition three premiums of 100, 75, and 50 guineas respectively for complete designs, including specification and estimate of cost. If this recommendation is adopted, notice of the competition will be given in due course. Finally, the Town Clerk says that in coming to a decision on any new designs which may be submitted, the Committee will not be fettered in any way by those which have been awarded the premiums in the preliminary competition, which was for the purpose of ascertaining the maximum accommodation which could be obtained on the site.

Books.

Notes on the Construction of Cranes and Lifting Machinery. By Edward C. R. Marks, M.I.M.E. London: John Heywood. 1892.

These notes were originally written in the form of a series of articles for the *Practical Engineer*, and have appeared in that journal at different times during the last two years. The information given is of a practical nature, and such as is often required by engineers and purchasers who wish to have descriptions and particulars regarding the general principles and capabilities of lifting machinery.

Longman's School Mensuration. By Alfred J. Pearce, B.A. London: Longmans, Green, & Co. 1892.

In this little book the author explains, in a clear and concise manner, the principles upon which mensuration is founded, and gives in nearly all cases a simple proof of the rules, which can be easily mastered by all students who have but a slight knowledge of mathematics. Besides containing a large number of well-chosen questions at the end of each chapter, several examination papers have been introduced, and the book throughout is well furnished with such diagrams as are necessary to illustrate the various examples given in the text.

Pumps and Pumping. By M. Powis Bale, M.I.M.E., A.M.Inst.C.E. London: Crosby Lockwood & Son. 1892.

Much useful information of a practical nature will be found in this little book on pumps. Nearly all kinds of pumping machinery have been noticed, and more or less described, and what the author has to say on each subject has been conveniently arranged, under the form of headed paragraphs, so that the work is well suited for reference, especially in cases of emergency. A careful study of the book will well repay those who have to use and work pumps; and, although the matter has had to be considerably condensed, yet it is always given in a way that can be readily understood.

Sanitary State of Nantes.—According to a recent report of the British Consul at Nantes, although several new streets have been opened in various quarters, to the improvement in the appearance of the city and the health of its inhabitants, the sanitary condition of the town is deplorable, the drainage being indescribably defective, and the emanations from gratings in front of badly drained houses lay the germs of all kinds of diseases. An alteration in the existing system of drainage would entail an enormous expenditure, but it is to be feared that no change will take place until the townspeople are sufficiently enlightened to realise the benefit thereof. The quality of the water supplied to the town is so polluted that it is quite unfit for drinking until boiled and carefully filtered. The water is drawn at a point between two sewers, which pour into the river of the town, and the soiled linen is washed in the same stream. The new system of filtration through sand, recommended after a series of experiments by M. Lefort, the Chief Engineer of this town (see the *Builder* for November 15, 1890, page 393), has been approved by the Municipality, and estimates of its cost ordered, but to carry out the plans it will be necessary to compensate the water company.

Correspondence.

To the Editor of The Builder.

THE R.I.B.A. EXAMINATION.

Sir,—I have evidently not expressed myself clearly enough to avoid misinterpretation. My proposition is: that while the Examination is a sufficient and the only possible test of a proper education in architecture, it is no more a test of the capacity of a man as an architect than are the cognate examinations in Law and Physic of the skill of the graduates in the practice of either profession.

This seems a self-evident proposition, and I only restated it, because it appeared to me that in exercise of the right he claimed of "putting his own construction" on the expressed opinions of others, Mr. Pite and, presumably, some of his friends, were imputing to the body of the Royal Institute of British Architects the ridiculous pretention that the Examination was a test of a man's capacity as an architect.

The question I asked, and ask again, was whether, as seemed to be suggested, Mr. Pite wished to institute a more stringent examination in the art side of architecture.

At one moment it appears that what are called "the Memorialists" are against any examination in art, but at another it seems as if they wished to have a stricter examination, coupled with prizes or diplomas for proficiency.

Unless they define their position in this respect, they cannot expect that the body of the Royal Institute of British Architects will pay much attention to what appear to be efforts to obstruct the course of the Institute.

This is not an instance of particular obtuseness on my part, since I have not been able to find any one, even among themselves, who can clearly state what they want, although there appears to be a vague desire to do something for art.

If they say that all examinations in art are illusory, I and others are heartily with them, and we have only to point out that the examination deals only with the history and knowledge of past art and the power of expressing ideas by drawings; both of these are necessary, and can be tested.

If, however, they hold, as seems to me implied by Mr. Pite's words, that there should be a more stringent test, I have to say, for myself, that I repudiate as most undesirable and impracticable the attempt to impose as a test of admission to the ranks of a professional society the views on art that may happen to be current with any particular body of examiners. There is not a single phase of our latter-day developments of style that would not have been "snubbed" in its inception by such a body.

It is quite another thing for the Royal Academy and the Institute to endeavour to stimulate talent for design by a judicious system of prizes. No one need compete for these unless he choose, and no harm is done to the professional man working on other lines.

I do not wish in any way to misinterpret Mr. Pite's meaning, but the conclusion of his letter seems to point to what has been elsewhere obscurely hinted, that he wishes to limit the use of the word "Architecture" to the artistic side of building. If this be indeed the case, I must object to any small body of men taking upon themselves to alter the meaning of language.

Since the days of Vitruvius certainly, and probably for long before that, the attributes of an architect have included the practical and the business part of the profession; indeed, the artistic side is hardly talked about, since it is taken as a matter of course.

If this latter-day school wish for a distinctive name they must really invent a new one for themselves, and leave us the old name of architect. I aspire to be the architect or ruler of the building for the work that I do, and do not at all wish to sink to the position of surveyor's draughtsman, which is what the new departure must infallibly end in.

Ralph Nevill, F.S.A.

New Church, Feniscliffe, near Blackburn. —The new Church of St. Francis, which has for the last two or three years been in course of erection at Feniscliffe, near Blackburn, was on the 25th ult. opened by the Bishop of Manchester. The structure is built from the designs of Messrs. Aldridge & Deacon, of Liverpool.

The Students' Column.

CONCRETE.—VI.

NATURAL CEMENTS (CONTINUED).

II.—PLASTER OF PARIS.

PLASTER OF PARIS is ground from the clinker obtained by burning gypsum at a temperature of 120 to 130 degrees Centigrade, until nearly the whole of the moisture in the gypsum has been expelled. Gypsum, as we have already stated, is a hydrated sulphate of lime ($Ca\,SO_4 + 2\,H_2O$); plaster of Paris contains less moisture and is expressed thus:—$2\,Ca\,SO_4 + H_2O$. On the addition of water to the plaster the particles are converted into gypsum, which dissolve in the water. When this becomes super-saturated crystallisation takes place, and the gypsum is deposited in groups of fibre-like crystals. Plaster of Paris has long enjoyed a reputation as a good fire-resister, and for that reason it has been used in concrete, notably by Messrs. Dennett & Ingle, for fire-resisting floors and ceilings. It weighs about 64 lbs. per striked bushel, or one-third less than finely-ground Portland cement, and its strength likewise bears about the same ratio to that of the latter. Plaster of Paris cannot be used for concrete in foundations or in water, or for concrete walls or stucco exposed to the atmosphere, as it is soluble in water and gradually disintegrates. For floors and internal plastering, however, it can safely be used. It is often said that plaster of Paris resists the influence of fire more than any other cement, but we are of opinion that its fire-resisting properties have been much over-valued, and are inclined to think that it has no advantage in this respect over good Portland cement. A series of experiments have been carried out under the direction of Mr. J. J. Webster, M.I.C.E, which do not place plaster of Paris in a very favourable light. The results will be found in the "Proceedings of the Institution of Civil Engineers" (1890-1), vol. CV., part III. Briquettes, having a breaking area of $2\frac{1}{4}$ square inches, were made of various mixtures of plaster of Paris, with slag, fire-brick, and pumice-stone, and of Portland cement with the same and other aggregates. Ten briquettes of each kind were made, kept in air, and tested for tensile strength at the end of four or five weeks. Five of each were broken at the usual temperature of about 60 degrees Fahr. The other five "were carefully heated on the top of a specially built-up fire of coal and coke until they were of a light-red heat, the average time of exposure to the heat being about five minutes; they were then removed, and whilst hot were quenched with water. A large number of the briquettes lost all cohesive power after being quenched, and it was with difficulty that they were removed intact; as they could not in this state withstand any tensile strain, they were allowed to dry" for three days. They were then broken. A summary of the results is given in the following table, copied (with certain alterations) from Mr. Webster's paper:—

TABLE VIII.

Summary of Tests of Concrete Briquettes.

No.	Materials in Concrete Briquettes.	Proportions of Ingredients	Average Weight per cub. ft.	Breaking Weight per sq. in.		Average loss per cent. of original strength after Heating and Quenching.
				At Temp. of 60 deg. Fahr.	After being Heated and Quenched.	
			lbs.	lbs.	lbs.	
1	Portland cement	Neat	124·6	554·6	117·2	78·8
2	,, ,, and sand	1 to 1	120·9	448	93	79·2
3	,, ,, ,, ...	1 ,, 3	111·2	100·8	18·7	81·4
4	,, ,, ,, ...	1 ,, 5	109·7	74·6	15	79·8
5	,, ,, iron-furnace slag	1 ,, 4	163·08	108·1	23·06	78·6
6	,, ,, fire-brick	1 ,, 4	95.04	84·4	30·5	63·8
7	,, ,, pumice-stone ...	1 ,, 4	64·8	94·6	38·3	59·5
8	,, ,, coke-breeze	1 ,, 4	71·65	69·9	30·06	56·9
9	Plaster of Paris and fire-brick ...	1 ,, 4	89·6	66·8	10·3	84·5
10	,, ,, pumice-stone	1 ,, 4	55·6	57·4	3·4	94·07
11	,, ,, furnace-slag	1 ,, 2	148	223 6	4·7	97·8
12	,, ,, fire-brick	1 ,, 2	106·9	167·5	15·7	90·6

This table needs some comment. In the first place, there are evidently several clerical or printers' errors in the table as printed in the Proceedings C.I.E., for the average strengths of the briquettes given in the fifth and sixth columns do not tally in four cases with those calculated by the author from the individual tests, which are separately given by Mr. Webster. The only two, however, in which considerable variation occurs, are tests 8 and 11, column 6, where Mr. Webster has 39·06 and 6·9 instead of 30·06 and 4·7. But in the last column errors appear to have been made in calculation, and some of these were so great as to give quite a wrong idea of the relative value of the different mixtures; the author has therefore re-calculated the loss per cent. in all cases. The following are the figures given by Mr. Webster, 60·8, 80 0, 81·4, 79 8, 69·3, 50·9, 59·5, 57·1, 75·0, 94·7, 96·8, 90·0.

It ought also to be mentioned that out of the five briquettes of the several kinds, which were heated and quenched, one in No. 2 and one in No. 3 were "damaged before testing," three in No. 4 were "damaged before testing owing to their soft condition," one in No. 6 was "broken in adjusting in the machine," two in No. 9 were "too soft to be tested," and one in No. 10 and one in No. 11 were "damaged before testing." Of the briquettes tested in the ordinary way, two in No. 5, one in No. 6, one in No. 8, and one in No. 11 were "broken in adjusting in the machine," and another in No. 11 was "damaged before testing." Mr. Webster has based his calculations on the strength of the briquettes which were actually tested in the machine, and has ignored the absolute lack of strength in those briquettes which were too soft to be tested, and the apparent weakness of those which were damaged before testing. We are not told whether the damages to these last resulted from being heated and quenched, or from accident at the hands of the operator, but it certainly seems only fair that those briquettes which were too soft to be tested ought to be reckoned. If we do this, we find that the briquettes of Portland cement and sand (1 to 5) have an average strength after heating and quenching of only 6 lbs., and the loss of strength will, therefore, appear as 91·9 per cent., and this is certainly more in accordance with what we should expect for briquettes containing such a large proportion of sand. If we apply the same method to the briquettes of plaster of Paris and firebrick (1 to 4), of which two were too soft to be tested, we get an average strength in column 6 of 6 2 lbs., and a loss, after heating and quenching, of 90 4 per cent.

More valuable results would have been obtained if the plaster of Paris had been tested neat, and also with coke-breeze and with sand, in exactly the same manner as the Portland cement was tested, but the tests are sufficient to show that concrete of Portland cement is not only originally stronger than that of plaster of Paris, but that it also withstands the deteriorating influence of fire and water better. The only tests which are strictly comparable are Nos. 6 and 7 on the one side, and Nos. 9 and 10 on the other. These show that briquettes of Portland cement and firebrick (1 to 4) are originally 26 per cent. stronger than similar ones of plaster of Paris and firebrick, while after heating and quenching they are no less than 196 per cent. stronger, or, reckoning the two soft briquettes, 392 per cent. stronger. Tested with four parts of pumice-stone, Portland cement is originally 64 per cent. stronger, and after heating and quenching, it is actually 1,026 per cent. stronger than plaster of Paris. The average loss of strength caused by heating and quenching the Portland cement briquettes in the series Nos. 6 and 7, is 61·6 per cent., while the plaster briquettes in Nos. 9 and 10 lost 89·2 or (more correctly, we think) 92 2 per cent. The test, of course, was very severe, and concrete can hardly ever, in actual construction, be heated to such a degree and quenched so quickly, but it leads us to believe that Portland cement resists fire better than does plaster of Paris.

Mr. Hamor Lockwood made several blocks of concrete, some with gypsum and broken retorts (1 to 3), and others with Portland cement and burnt shale (1 to 4). At the age of six weeks they were all "subjected to intense heat for 1 hour and 45 minutes, after which they were plunged into water for 8 minutes, and when taken out those made with gypsum were completely disintegrated; whilst it took considerable force, applied with a sledge-hammer, to break those formed with Portland cement." These tests would have been more valuable if the nature and proportion of the aggregate had been the same in each case, but they certainly point to the truth of our contention, that the fire-resisting properties of plaster of Paris and allied cements have been greatly over-estimated.

The average tensile strength of neat plaster of Paris briquettes, kept in air, was ascertained by Mr. Lockwood to be 355 lbs. per square inch, and of neat Portland cement briquettes 649 lbs. per square inch, all being made at the same time, and tested at the end of fourteen days. Some briquettes of plaster of Paris were immersed in water, but would not set there.

Robinson's cement is, like plaster of Paris, a sulphate of lime. It is calcined from alabaster quarried at Knothill, near Carlisle, and is used not only for plastering, but also for concrete. The same statements are made about its fire-resisting qualities as are made about plaster of Paris; but no results of tests are given by the manufacturers in proof of these statements, and until we receive such results we must conclude that the cement is no better than Portland cement in this respect, and perhaps no better than plaster of Paris.

The strength of a sample of the cement was tested by Mr. Henry Faija in 1885, and excellent results were obtained, as shown by the following table:—

TABLE IX.

Tensile Strength of Robinson's Cement in lbs. per sq. in.

		At 3 days.	At 7 days.	At 28 days.
		lbs.	lbs.	lbs.
Cement.....	Neat	497	549	784
,, and sand	1 to 2	—	459	525
,, ,,	1 to 4	—	297	331

The figures are each the average of five tests, and show the cement to be equal in tensile strength to the best Portland cement.

The resistance to crushing of neat Robinson's cement was found by Mr. Faija to be "3,761 lbs. per cubic inch" at the age of five weeks, the average of five tests being taken. The compressive strength is about 18 per cent. less than that of Portland cement tested in a similar manner by the same person but not at the same time.

It is said that the cement is slow-setting and easy to work; that it may be used for an hour and a half after being gauged without detriment to its ultimate strength, and that in setting it "neither expands nor shrinks." As we all know, plaster of Paris expands somewhat in setting.

ARTIFICIAL CEMENTS.

1. *Slag Cement.*—A somewhat curious instance of the utilisation of waste-products is found in the manufacture of cement from iron furnace slag. For a number of years experiments have been made to this end, but without much success, the chief difficulty being that of pulverising the slag to a sufficient degree of fineness. The hardness of the slag has played havoc with the grinding-machines.

Composition.—All slags are not adapted for conversion into cement, as some contain substances which would prove injurious in cement, or do not contain the necessary ingredients in suitable proportions. A suitable slag may contain about 36 per cent. of lime, 30 per cent. of silica, and 23 per cent. of alumina. If to this slag 30 per cent. of slaked fat lime were added, we should have a mixture containing 46 5 per cent. of lime, 25 per cent. of silica, 19 per cent. of alumina, and 9·5 per cent. of iron and other

substances. This is actually the approximate composition of one slag cement, and differs from the composition of Portland cement in one or two particulars, notably in having from 11 to 14 per cent. less lime and about double the quantity of alumina. In some slag cements the proportion of lime is about 50 per cent. of the whole. Sometimes the slag contains an excessive amount of sulphur, and the cement made from it is of dangerous quality.

Manufacture.—Until recently, experimenters re-calcined the slag with the lime which had been added to it, but Messrs. Bosse & Walters a few years ago introduced a new process which seems to promise success. It was fully described by Mr. Gilbert R. Redgrave, A.I.C.E, in a paper which will be found in the "Proceedings of the Institution of Civil Engineers" (1890-91), vol. cv., part iii., and to this paper the author acknowledges his indebtedness for much of the information given in this chapter.

"The slag, on issuing from the furnace," says Mr. Redgrave, "is passed through a stream of water, by which means it is mechanically reduced to a spongy and readily-crushed material." After crushing, the slag-sand is dried and ground to a fine powder between ordinary millstones. To the ground slag is added the requisite quantity (about 25 or 30 per cent.) of pure lime, which has previously been thoroughly slaked, screened, and dried. The mixture is then introduced into a machine called a "homogenizer," where it is more intimately mixed and more finely ground in a revolving drum partly filled with small iron or steel balls. In about an hour the cement is withdrawn, and ought to be ready for use at once, for as the lime which is not in combination ought all to have been thoroughly slaked and screened air-slaking should not be necessary. The colour of the cement varies according to that of the slag from which it is made, but it is usually lighter than Portland cement, on account of the slaked lime which it contains.

Slag cement is usually slow-setting, requiring from two to five hours before it resists a moderate pressure of the thumb-nail. "When made up neat, it is more plastic and unctuous than Portland cement, and yields a richer and fatter mortar."

The theory of the induration of slag cement will be considered in the chapters on "Portland cement." The same kinds of tests ought to be applied to slag cement as to Portland, namely, fineness, tensile strength, specific gravity, and perhaps weight. The soundness test also may be applied, for it is possible for a slag cement to "blow."

Weight.—The weight may be as little as 85 lbs. per striked bushel, and seldom exceeds 95 lbs., or over 15 per cent. less than ordinary Portland cement. Probably the small weight of slag cement is due chiefly to its extreme fineness, as there are instances of Portland cement as ordinarily ground, weighing 115 lbs. per bushel, while the same cement, ground extremely fine, weighed only 90 lbs. per bushel.

Fineness.—On the importance of fine-grinding we shall not dilate here. Suffice it to say that fineness, especially in slag-cement, is of extreme importance. Mr. Redgrave declares that slag-cement ought to leave no residue at all on a No. 75 sieve (5,625 meshes to the square inch), and not more than 15 to 20 per cent. on a No. 180 sieve (32,400 meshes to the square inch). Now and then Portland cement has been tested, which has shown a degree of fineness equal to the standard here demanded for slag cement, but, as a rule, 10 per cent. residue on a No. 50 sieve is considered a fair test for Portland cement. A sample of slag-cement tested at the Royal Testing establishment at Berlin, in December, 1886, left no residue at all on a sieve with 1,160 meshes to the square inch, only 1 per cent. on one with 3,870, 5 per cent. on one with 5,800, and 14 per cent. on one with 32,200 meshes, but this, it must be remembered, was a manufacturer's sample.

Tensile Strength.—Good slag-cement, tested neat, is as strong as neat Portland cement, but, according to Mr. Redgrave, it gives considerably better results than the latter when both are tested with three-parts of sand. The tensile strength of the cement, mentioned in the last paragraph, was ascertained at Berlin to be as follows:—

TABLE X.

Tensile Strength of Slag-Cement.

	At 7 days. lbs. per sq. in.	At 28 days. lbs. per sq. in.
Slag-cement, neat	647	692
" " and sand 1 to 3	427	509

Each result is the average of ten briquettes, which were kept in air for twenty-four hours after gauging, being covered with writing-paper to retain the moisture, and were then kept in water for the rest of the time. The strength of the sand briquettes is exceedingly great, and is equal to that of some Portland cements tested neat; the German standard for Portland cement requires a tensile strength of 227·6 lbs. per square inch, tested with three parts sand at twenty-eight days, and the highest tensile strength of Portland cement so tested, which has come under our observation, is 10 per cent. less than that of the slag-cement as recorded above. We must not, however, imagine that all slag-cements give equally good results; we must not generalise from particular instances.

No tests of the adhesive strength of slag-cement have, as far as we know, yet been made, but its capacity for sand shows that this must be very high.

Compressive Strength.—Briquettes of slag-cement, mixed with three parts of sand, were made at Berlin as already described, and were crushed, on an average, by a force of 3,376 lbs. per square inch at seven days, and 4,296 lbs. at twenty-eight days. Briquettes of Portland cement and sand, similarly tested by Messrs. Dyckerhoff, had an average strength of 4,822 lbs. at 28 days, or 12 per cent. more than the slag-cement ones.

Uses.—It can be used in all situations for which Portland cement is adapted, and has been employed in the construction of harbours and other works in the sea, as at Skinningrove, in North-East Yorkshire, and other places. For stucco and plastering and for concrete generally it is suitable. It has been used also for paving, but, according to Mr. Redgrave, it does not attain as hard a surface as Portland cement; its superior adhesive strength, however, enables it to bind the hard aggregate of the paving, such as granite and quartz, "into a firmer mass than Portland cement does." Mr. G. M. Lawford states that its fire-resisting properties "exceed those of both gypsum and Portland cement," and for this reason, among others, it can be recommended for use in concrete floors and roofs, &c.

OBITUARY.

MR. H. H. MACLURE.—The remains of Mr. Hugh Heugh MacLure, civil engineer and architect, who died at his residence, Wellwood, Bearsden, Dumbarton, on the 31st ult., were interred on the 3rd inst. According to the *Glasgow Herald*, Mr. MacLure was connected with the firm who were engineers for the Glasgow and South-Western Railway, and carried out a great part of the work of that system. He afterwards turned to architectural work, and prepared plans for several schools for the Glasgow and other School Boards. He also erected churches in many parts of the country. The late Mr. Whitelaw, M.P., selected him for the architectural work connected with the churches at Coats and Bellshill; and he carried out four additions to the Parish Church of New Kilpatrick.

MR. ROBERT THOMPSON.—According to the *Liverpool Post*, the remains of Mr. Robert Thompson, for many years Surveyor to the Waterloo Local Board, who was found dead in bed on the 27th ult., were interred at St. Luke's Churchyard, Great Crosby, on the 30th ult.

GENERAL BUILDING NEWS.

KINGSTON CHURCH TOWER (NEAR TAUNTON).—This fine Perpendicular tower has for some time past caused anxiety to its custodians on account of certain cracks, in the eastern and western walls more particularly, which have apparently been increased by an unequal oscillation of the two sides of the tower when the bells were rung, and from other causes. Steps are now being taken to improve and strengthen the structure generally by removing the comparatively modern "rough-cast" from those parts of the walls to which it still adheres, and by pointing the stonework, after all cracks and fissures have been bonded with stones and filled with liquid mortar, and copper cramps applied to the dressed stonework on the lines of the cracks. Some portions of the ashlar and the Ham stone dressings have not been coated with "rough-cast," and the mellow tone of colour imparted to them by time and lichens of varied hues will not be disturbed. The work has been carried out under the direction of Mr. J. Houghton Spencer, architect, of Taunton.

VILLA RESIDENCES, BURTON-ON-TRENT.—Several villa residences are being erected in the neighbourhood of Burton-on-Trent, of which Mr. R. E. Carpenter, of Burton, is the architect,—one at Tutbury, for Mr. W. Barker; one on Branstone-road Burton, for Mr. C. O. Hall; and two semi-detached in Derby-street, Burton, for Mr. Collyer. The builder for the Tutbury residence is Mr. Dickinson, and for the Burton residences, Mr. Hodges.

CHURCH OF ST. JAMES'S, ROUNDS GREEN, WORCESTERSHIRE.—The new Church of St. James, at Rounds Green, was dedicated by the Bishop of Worcester on the 25th ult. The church consists of nave, chancel, vestry, and organ-chamber, and will accommodate 300 people. The roof of the nave is an open timbered one with hammer-beam principals, and all timber is stained and varnished. The seats are open pitch-pine benches. The altar-table is of oak, with trefoil heads and carved sprandrels. The three chancel windows are of stained glass, executed by Mr. Samuel Evans, of Smethwick, the central subject being the Good Shepherd. The organ is enclosed in a pitch-pine case. The pulpit is of polished oak, with traceried panels. The font is of Caen stone, octagonal in form, with shafts of alabaster, and has carved caps and bases. Messrs. Jones & Willis, of Birmingham, have supplied most of the chancel furniture, &c. The whole of the church is heated by hot water, the work for which has been carried out by Messrs. Jones & Attwood, of Stourbridge. The lighting of the church is by gas coronas, and this work, together with the altar rail and standards, has been executed by Messrs. Thomason, of Birmingham. The exterior of the church is Gothic in style. The structure is surmounted by a bell-turret. The whole of the work has been executed by Mr. H. Willcock, builder, of Wolverhampton, from the designs and under the superintendence of Messrs. Wood & Kendrick, architects, of West Bromwich.

PROPOSED COTTAGE HOSPITAL FOR NUNEATON.—According to the *Birmingham Daily Gazette*, it has been decided to build a cottage hospital for Nuneaton and district on ground situate near the Midland Railway Station. It is estimated that the cost of the building, independent of furnishing and laying out the grounds, will be 2,000*l.* Building operations are to commence immediately, the architect being Mr. F. J. Yates, of Birmingham.

SCHOOLS, SULHAM, BERKSHIRE.—On the 9th ult. new schools were opened at Sulham, Berkshire. The school has been built not only to meet the requirements of the Education Department, but also to provide a meeting-place and room for entertainments, village concerts, &c., and it is designed to accommodate the entire inhabitants of the parish. It is constructed of grey brick and flint, relieved with red brick and Corsham Down stone, the roofs being covered with brindled Staffordshire tiles surmounted by a bell-turret. The work has been carried out by Mr. James Wigmore, builder, of Theale, under the direction of Mr. F. W. Albury, architect, of Reading.

BOARD SCHOOLS, MANOR PARK, ESSEX.—The new schools built by the East Ham School Board at Manor Park were opened on the 21st ult. The schools were designed by Mr. Curtis, the builder being Mr. Reed, of Stratford The total cost is about 10,580*l.*, and, including the provision for cookery classes, the accommodation is for about 940. The children's school is on the ground floor, the girls' school on the first floor, and the boys' school on the top floor.

WESLEYAN CHAPEL, NEWBRIDGE, DEVONSHIRE.—On the 29th ult. two corner-stones were laid of a new Wesleyan Chapel at Newbridge, in the St. Just circuit. The new building will include a wing which will be utilised for Sunday-school purposes, and separated from the chapel by folding screens. The new chapel will seat 150 persons. The architect is Mr. J. W. Trounson, Penzance. The contract is let to Messrs. Gibson and R. Marks, St. Just.

NEW CHURCH, HEDGEFIELD, DURHAM.—On the 30th ult. the Church of St. Hilda's, Hedgefield, was consecrated by the Lord Bishop of Durham. The church, which will serve as a chapel of ease in the parish of Ryton, is situated on the main west road. The building consists of a nave, with one aisle. It is capable of holding 350 people, and the cost of the work has been 3,500*l.* Messrs. Oliver & Leeson, of Newcastle, were the architects, and the contract for the building was let to Mr. Pringle, of Newcastle.

MANCHESTER CATHEDRAL RESTORATION.—According to the *Manchester Courier*, the lowering of the Cathedral floor, which has been going on in the Trafford and Browne chapels, on the south side, for some weeks, is now being extended throughout the nave. It is expected that the work will be completed by the first Sunday in September. Probably the new south porch will be ready for opening about the same period.

PRIMITIVE METHODIST BUILDINGS, BRADFORD.—On the 23rd ult., the foundation-stone was laid of a new building for the Primitive Methodists of Bradford, to be known as the Central Hall. Its erection will entail an expenditure of 4,700*l.*, and the architects are Messrs. H. and E. Marten. On the ground floor are to be two large shops, one on either side of the vestibule and entrance-hall, which will give access to the chapel and schools. The latter were built twelve years ago at the rear of the chapel. On the first floor will be the Central Hall, a room 55 ft. square. Galleries are to occupy three sides, and altogether there will be accommodation

for about a thousand people. The galleries will be supported on cantilevers, bolted into the outside walls. The contractors for the erection of the building are,—Mason's work, Messrs. Humphrey & Moulson; joinery, &c., Mr. Jas. Deacon; plumbing, Mr. G. Jackson; slating, Mr. A. Hill; plastering, Messrs. B. Dixon & Co.; iron work, Messrs. Homan & Rodgers.

Catholic Church, Tranent, Haddington.—The new Catholic church, dedicated to St. Martin, the erection of which has just been completed, was opened on the 28th ult. The church has been built from designs by the late Mr. J. Biggar, architect. It consists of nave and chancel, and is seated for about 420 persons. The altar, which is constructed of white Seaton stone, is carved after the Gothic style, with shafts of polished alabaster supporting the altar-table, a crocketted canopy over the tabernacle, and statuettes set in canopied niches. Together with the chapel-house, which adjoins it, the structure has cost about 2,000*l*.

The Free Church at Dufftown, N.B., which has been undergoing extensive alterations and additions for the last twelve months, was re-opened on the 27th ult. The church is almost of the form of a Roman cross, and is built of Spynie freestone. The most prominent feature in the exterior of the building is the tower, which is situated at one of the corners of the main front and stands about 60ft. high. It rises to the height of 40ft. as a square tower, it then assumes an octagon form and finishes with a spire. The main front is in gable form, and the principal feature is a five-light window, provided through the generosity of Lord Mount Stephen. It has cusped and foliated tracery, and it, like all the other windows of the church, is filled with stained glass. The whole of the interior finishings are of pitch-pine, varnished. The church is heated by the high-pressure system. Mr. James Souttar, architect, Aberdeen, designed and superintended the work.

Church Schools, Wilmslow, Cheshire.—New church schools have just been completed at Wilmslow at a cost of 1,700*l*. The new institutions provide accommodation for 300 children. The architect is Mr. H. Lord, of Manchester, and the contractor Mr. J. K. Coates, Wilmslow.

Baths and Wash-houses, Bow.—The public baths and wash-houses erected by the Vestry of Bow were opened on the 27th ult. by the Chairman of the Commissioners, Mr. Isaac James Booth. The buildings have a frontage of 50 ft. to the Roman-road. Inside are two swimming-baths, one 90 ft. by 30 ft., and one 87 ft. by 30 ft., the larger provided with a gallery to hold 300 persons. There are in the wash-houses forty compartments. The architects were Messrs. Harnor & Pinches. All the skylights over the baths, corridors, &c., have been glazed on Rendle's "Invincible" system, sheets of glass as long as 9 ft. 6 in. being used.

Church, East Layton, Yorkshire.—A new church is in course of construction at the village of East Layton, situate about ten miles west of Darlington. It is designed with nave, chancel, transepts, central tower, and south porch; and is in the Late Gothic or Tudor style. The drawings show three-light windows in the nave, two-light in the chancel and transepts, four-light west, and five-light east windows. The ceilings will be of fan tracery-groining, springing from moulded wall-shafts, with moulded and carved bases and caps. The tower has octagonal buttresses at the angles, surmounted by pinnacles. The floors of the chancel and aisles are intended to be in mosaic. The architects are Mr. J. P. Pritchett and Mr. H. D. Pritchett, of Darlington, and the clerk of works is Mr. Dodds.

SANITARY AND ENGINEERING NEWS.

Midsomer Norton Sewage Inquiry.—Major-General H. D. Crozier, R.E., held a Government inquiry on the 12th ult. with regard to the application of the Board for a loan for sewage purposes and water-supply. The Chairman of the Board, Mr. F. Bird, C.C., explained that the scheme was promoted with a view to prevent an injunction being applied for by the Radstock Board against them to obviate the nuisance caused by the overflow of the existing sewage tanks into a brook. The system recommended and explained by the engineer, Mr. C. Nicholson Lailey, of Westminster, is that known as the international process of precipitation by ferozone and filtration through polarite beds. Dr. Angell, F.I.C., County Analyst, Southampton, was in attendance to describe the chemical action of the process, and in the course of examination stated that the admission of surface-water to a reasonable extent facilitated any process of purification (whether by irrigation or chemical treatment combined with polarite filtration) by reason of the oxygen contained in the water.

Destructor, &c., Toxteth Park, Liverpool.—On the 28th ultimo an inquiry was opened at St. George's Hall, Liverpool, before Major-General Crozier, R.E., and Mr. T. W. Thompson, Inspectors of the Local Government Board, concerning an application of the Toxteth Park Local Board for sanction to borrow the sum of 17,400*l*. for the construction of destructor works, additions to hospital, mortuary, and other works, from the plans prepared by Mr. John Price, Engineer and Surveyor to the Board. Mr. T. de Courcy Meade, Engineer to the Hornsey Local Board, and Mr. J. A. Brodie, of Liverpool, were called to give evidence on behalf of the Board in favour of the proposed destructor works, to which there was some opposition by the Wavertree Local Board, represented by Mr. I. Dixon, Surveyor to that Board, and certain landowners, represented by Mr. Pain and Mr. Wylie, of Liverpool. The Inspectors ultimately visited the sites of the various works, and will report thereon in due course.

Sewage Works, Gorton, Lancashire.—The ordinary meeting of the Gorton Local Board was held on the 28th ult., Mr. W. G. Jones, the chairman, presiding. It appeared from the minutes that the Sewage Committee had met three times during the past month for the purpose of considering the sewage scheme for the district and the erection of a refuse destructor, and at the meeting held on the 28th ult. the Committee passed the following resolution:—"That the Board be recommended to adopt a sewage purification works and drainage scheme for the district; that the scheme of Messrs. Lomax & Lomax, of Manchester and Bolton, be approved and adopted generally, without deciding on the chemicals to be used; that a refuse destructor be provided for the district (details to be left to the Committee); that an application be made to the Local Government Board for power to borrow the money necessary; that Messrs. Lomax & Lomax at once prepare the plans and estimates necessary; and that the Clerk (Mr. R. P. Holland) forward the necessary information to the Local Board." The Board approved this resolution without discussion. The estimated cost of the scheme is 23,904*l*., and of the destructor 3,000*l*.

FOREIGN AND COLONIAL.

France.—M. Eugène Chaperon, the military painter, has just completed a large mural painting in the officers' library at Fort Valérien.——The State has ordered, at a cost of 30,000 francs, an engraving of a curious picture by Meissonier, representing a scene in the siege of Paris in 1870.——The Louvre has just obtained, for the Renaissance section, a remarkable bas-relief in bronze (Italian work), representing the profile portrait of Cardinal Francesco Alidosi.——A public competition is to be opened in Paris for the construction of the Hôpital Boucicaut, to be built in Rue Vouillé and Rue de Lourmel, by a legacy of the late proprietor of the "Magasins du Bon Marché."——The Commission Supérieure des Bâtiments has decided to apply part of the sum gained by the sale of the Crown diamonds to the repair of the national palaces, the Louvre particularly, on which two million francs will be employed, and half-a-million on Fontainebleau and Compiégne. Versailles has already a special fund.——MM. Barrias and Denys Puech, the sculptors, have just completed a splendid funeral monument which is to be erected shortly in the Saint-Geniez Cemetery at Aveyron, to the memory of Mdme. Paulin-Talabot, wife of the former Director-General of the Paris, Lyons, and Mediterranean Railway Company. The monument is at present on view in Paris, at 40, Rue Ampère. M. Lucien Magne was the architect for the general design.——There is talk of selling the sites and buildings of most of the civil and military hospitals at Paris and replacing them by new hospitals constructed in the suburbs. If this project is carried out, only the Hôtel Dieu and the Lariboisière hospitals will be preserved within Paris, as provisions for urgent cases.

Life Assurance Offices, Calcutta.—According to the *Bombay Gazette*, the Standard Life Assurance Company are about to erect, in Dalhousie-square, Calcutta, a new suite of offices, and Mr. F. W. Stevens, their consulting architect, has designed plans for the structure. The principal facade is in Dalhousie-square, and will be 176 ft. in length. The style is Classic Renaissance. The building will have ground, first, second, and third floors. At the north-west angle there will be a tower 142 ft. high, topped by a masonry dome. The material used in the building will be brick and terra-cotta, or brick and white stone. There is a group of sculpture in the main gable representing the Seven Virgins with their lamps, and a colossal figure of Atlas forming a terminal. The arms and monogram of the Company are also freely introduced. Over the main entrance the Royal Arms are carved. Arrangements have been made with the Government to allow the Company to build over the north portion of the premises now used as the body-guard stables, with the proviso that Government are allowed to occupy the ground floor. Provision in the internal structure of the premises is, therefore, made for the stables. The site of the building is divided in the centre by Vansittart-lane, and it is proposed to bridge the lane on each floor of the building. The interior of the building is designed specially for use as offices. The part of the building to the left of Vansittart-lane is to be made suitable for a bank or a large shop, whilst the first and second floors are designed for suites of offices. The Company's offices will occupy the third floor, together with residential quarters. Each set of offices has a fire-proof safe, and communication with the upper stories will be by means of a grand staircase and a hydraulic lift. The new building is estimated to cost about Rs. 3,75,000.

MISCELLANEOUS.

Choir Screen, Tewkesbury Abbey.—An oak choir screen, from a design by Mr. J. Oldrid Scott, has recently been erected in Tewkesbury Abbey. The new screen stands under the western arch of the tower, and completes the enclosure of the choir. It consists of a central arch, with openings on each side; the cornice overhangs considerably towards the east and west, and is enriched with a cresting of intricate design as well as with a belt of hanging tracery. The total height from the nave floor to the top of the cresting is about 17 ft. Above this rises the cross, about 9 ft. high, with figures of the Blessed Virgin and St. John on each side, which have been carved by Mr. Boulton, of Cheltenham.

The English Iron Trade.—In the crude iron branch of the English iron market rather more activity is observable, and in Scotch makers' iron several brands show an increase in value; but Middlesbrough pig is lower. In the manufactured iron department there is little doing, and tin-plates are quieter. The steel trade is a trifle brisker, chiefly in the rail mills. Heavy steel rails exhibit an advance of 4s. per ton on the week. Shipbuilders and engineers continue moderately engaged. The coal trade is fairly steady.—*Iron.*

The Junior Engineering Society.—The Summer Excursion of this Association will commence on Friday, August 12, when the members will leave Euston Station at 8 p.m. for Crewe. On Saturday, the 13th inst., they will visit the Crewe Locomotive Works of the London and North-Western Railway, and proceed in the afternoon to Chester to visit the Cathedral, Castle, &c. They will remain at Chester on Sunday, the 14th, and on the 15th they will visit Messrs. Hulse's Ordsal Tool Works, the sewage works of the Salford Corporation, and Messrs. Mather and Platt's Salford Iron Works. On Tuesday, the 16th, they will visit Bolton, where they will see Messrs. Dobson & Barlow's Kay-street Textile Engineering Works; and Messrs. John Musgrave & Sons' Globe Iron Works. On Wednesday, the 17th, they will visit Messrs. Richard Haworth & Co.'s Cotton Spinning Mills and Manufactory; and Messrs. Schwabe & Co.'s Calico Printing Works. The summer dinner of the Society will be held in the evening at the Grosvenor Hotel, Manchester. On Thursday, the 18th, the members will visit the Manchester Ship Canal Works, proceeding from the Pomona Docks, Manchester, to Eastham; thence by steamer to Liverpool. On Friday, the 19th, they will visit the Liverpool Docks, &c., of the Mersey Dock Estate, the Overhead Railway, the Alexandra Grain Warehouse, and the Royal Mail Steamship *Teutonic*. On Saturday, the 20th, they will visit Messrs. Laird Brothers' Birkenhead Iron Works, and will return to London by train from Lime-street at 2 p.m.

The Roscoe Collection, Liverpool.—The *Liverpool Mercury* says that "it is at last proposed to remove the valuable collection of old masters' pictures and casts from the Gallery of Art, Colquitt-street, where they are seldom seen, and house them in the Walker Art Gallery, where they will be easily accessible. Just as it is said that the world knows nothing of its greatest men, it may be said that the Liverpool public in general knows nothing of the Roscoe treasures contained in the gallery of the Royal Institution. Yet this collection ranks amongst the first three of the galleries in England, and the series of casts, containing those from the Elgin marbles (presented by George IV.), and others, besides some splendid friezes, is one of the finest in the country. It is only matter of fact to state that for thousands who visit the Autumn Exhibition and the Permanent Collection in the Walker Art Gallery, hardly one enters the gallery in Colquitt-street. The chief portion of the collection of the latter consists of pictures formerly belonging to William Roscoe, and which, on the dispersion of his collection, were purchased by friends and admirers and presented to the Royal Institution. For the last twenty-three years the growth of the gallery has ceased. At present the antique-room is the home of the life-school of the Liverpool Academy."

Engineering Trades' Report.—Messrs. Matheson & Grant's half-yearly report says that trade has gradually slackened since January, and when compared with the activity of the two preceding years, the present position of affairs appears depressing. But just as the recent prosperity never reached the inflated and unsound condition that accompanied the great revivals of 1872 and 1881, so now the re-action is of a milder kind. The swing of the pendulum has a less range. Manufactories and ironworks have not been unduly extended during busy times; there is no great excess of productive power; and there is a steady

COMPETITIONS, CONTRACTS, AND PUBLIC APPOINTMENTS.

COMPETITIONS.

Nature of Work.	By whom Advertised.	Premium.	Designs to be delivered.
*Drainage and Sewerage Disposal Schemes	Mytho'mroyd L. B. ..	60l. 25l. and 15l.	Oct. 1
Church, Offices, and Hall, Falkirk	The Deacons' Court ..	....	do.

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
70 yards of Hassall's Pipe Sewer	Poulton-le-FyldeUnion	A. M. Fowler	Aug. 9
Painters' Work, Public Hall, &c.	Manchester Corp.	*Official*	do.
Houses and New Street, Woodhouse, Sheffield ...	Truswell's Brewery Co.	T. S. Wheen.....	do.
*Plumbers' Work at Workhouse	Edmonton Union	T. E. Knightley	do.
*Wood Paving	Willesden Local Board	O. Claude Robson	do.
Re-roofing St. David's Church, Neath	The Churchwardens ..	.....	Aug. 10
Two Houses and Shop, Robin Hood, near Wakefield	.....	T. A. Buttery	do.
Sewer, Bucknall	Stoke-on-Trent R.S.A.	*Official*.....	do.
*Cleansing, Distempering, &c. at Infirmary	Hackney Union	do.	do.
Waterworks, Milnathort, Kinross	County Council	Niven & Hadden.....	Aug. 11
Restoring Wesleyan Chapel, &c. Redmire	The Trustees	Septimus Moors	do.
Renovation of Troon Chapel, Camborne.	.....	T. Harvey	do.
Post Office, Lisburn.....	Office of Public Works, Dublin.....	.....	do.
*Goods' Warehouse, Liverpool	Midland Railway Co.	*Official*	do.
*Sewerage Works	Cuckfield U.R.S.A. ..	W. Beach	do.
*House and Cottages, Langar (Notts.)	.....	Arthur Vernon	do.
1,200 cubic yards of Excavations, Alverthorpe	Colbeck Brothers	A. Fawcett	Aug. 12
Lighting Premises by Electricity	Hartlepool Co-op. Soc.	.....	do.
Six Houses, Mexbro', Rotherham	.....	J. C. Haller	do.
Ladies' Lavatories, Edinburgh	Magistrates and Council of Edinburgh	*Official*	Aug. 13
Diversion of the River Frome, &c.....	Bristol Corporation ..	do.	do.
Stone Tower and Spire, Clive Church, near Shrewsbury.....	.....	C. J. Ferguson.....	do.
Repairs, Police Station, Mildenhall	West Suffolk C. C.....	F. Whitmore	do.

CONTRACTS.—*Continued.*

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
*Fifteen Cottages at Cheshunt	.....	G. Bunce	Aug. 13
900 yards of Sewer Drain, Kilmarnock....	Public Health Com. ..	C. W. Mitchell and Laugharne	Aug. 15
260 and 700 yds. Pipe Sewers	.....	A. Pell, Beccles	do.
Road Works, Chertsey	Rural Sanitary Auth.	*Official*	do.
*Sanitary Works, &c. at Workhouse	St. Marylebone Guar.	A. Saxon Snell	do.
*Repairs and Alterations to Baths	St. Giles-in-the-Fields B. & W. Commrs. ..	.....	do.
Construction of Harbours, Sutherland ..	The Trustees	J. Waldram.....	do.
Extension of Scrabster Harbour.....	Caithness Harb. Trus.	James Barron (Aberdeen).....	Aug. 16
*Gates and Railings, Victoria Park.....	Bristol U.S.A.....	James Barron	Aug. 17
*Reservoir and Engine House	Norton Loc. Bd.....	*Official*	do.
Registrar's House, Two Chapels, &c.,.. .	Urmston Burial Bd..	do.	Aug. 18
Road Works, Banbury	Town Council	Whittenbury & Mather	Aug. 19
*Sewerage Works	Corp. of Newport (I. of W.).....	*Official*	do.
*Foundations for Asylum	Sunderland Boro' Asy. Com.....	Baldwin Latham	Aug. 26
*Extension of Workhouse	Barnet Union	G. T. Hine	Aug. 29
*Steam and Hot Water Works	do.	W. H. Mansbridge....	Aug. 31
Board School	S. Normanton Sch. B.	do.	do.
Class-room, National School, Rufford	The Committee	A. Macpherson	No date.
Public Hall, Club Rooms, &c.	Cwmbwrla Friendly Club	.....	do.
Board-room and Offices	Prescot Union.....	J. B. Wilson and G. Moxham	do.
		James Gandy	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.
*Inspector of New Buildings, &c.	Richmond T. C.	2l. 10s.	Aug. 10
*Assistant in Surveyor's Department	Hoyland Nether L. B.	.....	Aug. 26

Those marked with an Asterisk (*) are advertised in this Number. *Competitions, p.* iv. *Contracts, pp.* iv., vi., & viii. *Public Appointments, p.* xviii.

though moderate demand for engineering products, especially at home. Prices are fairly maintained, capital is abundant, and whatever be the new enterprises to which it may be applied, engineers must benefit. When the country has settled down after the recent Parliamentary election a solid and improving state of affairs may be reckoned on. On the subject of steel bridges and structures, the report says that this branch of trade still continues active, and as the number of firms with the skill and plant essential to high-class work does not tend to increase, those who are able to satisfy modern strict conditions of quality find employment accordingly. There is a considerable export, but the main dependence of manufacturers is at present on the home railways. Not only bridges for extensions and widenings are required, but new steel bridges for replacing old wooden, cast-iron, and decaying wrought-iron structures. While the main girders of bridges are being made stronger than formerly to meet the greater weight and frequency of modern traffic, the cross girders and platforms have also to be stronger to withstand the impact of engines having heavy loads concentrated on the driving axles. Skill and experience in the erection of bridges are necessary for work which has often to be done during the running of trains. There is not now so great a difference as formerly between the British and American forms of structure. While the advantages afforded by pin connexions are fully recognised here, such systems are only applied to long spans and in combination with solid rivetted work. In America, where speed in manufacture and facility in erection used to be the principal points aimed at, the frequency of failures in light, loosely-made, and insufficiently-stayed structures, nave, through the consequent expression of public opinion, brought the modes of construction nearer to those which prevail here. Roofs for railway stations and markets are being made, and there is always a demand abroad for such structures. Wrought-iron is not superseded by steel for such work, especially where smithing and welding have to be done.

PLASTERERS' STRIKE, NELSON, LANCASHIRE.—On the 30th ult. the plasterers at Colne and Nelson, Lancashire, struck work, demanding an advance from 7d. to 8d. The masters had agreed to concede an advance of ½d. an hour, but the men declined to accept it.

SURVEYORSHIP, BROMLEY (KENT).—Mr. Hugh S. Cregeen, who has held the office of Surveyor to the Bromley Local Board for upwards of twenty years, having been compelled through continued ill-health to resign that appointment, has since been appointed Consulting Engineer and Surveyor to the Board at a salary of 150l. per annum.

HEALTH EXHIBITION AT NOTTINGHAM. — An exhibition of sanitary appliances has been held in connexion with the annual meeting of the British Medical Association in Nottingham, under the joint patronage of the Association and the Nottingham Corporation. The Corporation lent the covered and wood-paved yard (measuring 100 ft. square) at the rear of the Guildhall, and laid the necessary water mains. The patent-jointed drain-pipes of Messrs. Parker & Hassall were laid under the stalls, and connected with the nearest street sewer. This complete system of water-supply and drainage enabled all working hydraulic apparatus to be shown in operation.

MEETINGS.

MONDAY, AUGUST 8.

Clerks of Works' Association (Carpenters' Hall).—Monthly Meeting. 8 p.m.

Cambrian Archæological Association. — Annual meeting, to be held at Llandeilo-Fawr, Carmarthenshire.

TUESDAY, AUGUST 9

Royal Archæological Institute.—Congress at Cambridge.

Cambrian Archæological Association. — Annual meeting, Llandeilo-Fawr, Carmarthenshire (continued).

WEDNESDAY, AUGUST 10.

Royal Archæological Institute.—Congress at Cambridge (continued).

Cambrian Archæological Association. — Annual meeting, Llandeilo-Fawr, Carmarthenshire (continued).

THURSDAY, AUGUST 11.

Royal Archæological Institute.—Congress at Cambridge (continued).

Cambrian Archæological Association. — Annual meeting, Llandeilo-Fawr, Carmarthenshire (continued).

FRIDAY, AUGUST 12.

Royal Archæological Institute.—Congress at Cambridge (continued).

Cambrian Archæological Association. — Annual meeting, Llandeilo-Fawr, Carmarthenshire (continued).

SATURDAY, AUGUST 13.

Royal Archæological Institute.—Congress at Cambridge (continued).

Junior Engineering Society.—Visit to the Crewe Locomotive Works.

Liverpool Engineering Society.—Visit to the Mersey Aqueduct Tunnel and Norton Water-Tower, by permission of the engineer, Mr. G. F. Deacon.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

8,749.—DRAIN-TESTING: *H. E. Burnet and W. E. Groom.*—This invention relates to an improved device or apparatus for testing drains and soil-pipes by means of smoke and smell, but especially the former. The inventors use a case, bent or curvilinear in shape as to its length, and charged with any suitable substance to spontaneously emit smoke and smell upon being ignited. Its rear end may have a cane or rod about 6 in. long or more in length, connected to it by a fixed or movable joint. For the purpose of ignition the case may have a quick or slow match communicating with the combustible substance in its forepart, and extending to its rear end or beyond, or the case may be provided with a match or fusee, and an apparatus for igniting it by friction upon pulling a cord, wire, or the like, connected therewith. The rear end may have a hollow chamber for the purpose of inserting a small charge of any suitable explosive substance. The case may be of any suitable shape as to thickness, and of any suitable length.

12,281.—PAINT BRUSHES: *G. Barker.*—The object of this invention is to design a bridle for paint and calsomine brushes, which will hold the bristles together without interfering with the pliability of the brush, and it consists essentially of a narrow or wide band fitting around the bristles, and pivotally connected to the head of the brush.

13,895.—WATER-CLOSETS: *J. Breeden.*—A simple and inexpensive apparatus for the flushing of water-closets and other places, and one not liable to get out of order. It is wholly independent of the cistern with which it is used, being connected therewith by a single screw junction. In making the apparatus, the inventor forms preferably of cast-iron, and in a single casting, a syphon, the descending leg being of the ordinary tubular shape. The other, or ascending, leg is much larger in diameter than the descending leg, and is of such a size and shape as to permit of the reception and working of a flap hinged in the interior and near the bottom of the ascending leg. A lever turning upon a fulcrum at the top of the syphon is so connected with this flap that when the cord or chain attached to the lever for working the apparatus is pulled down, the flap is suddenly raised upwards. The apparatus is fixed to the cistern by the bottom of the descending leg of the syphon being screwed to the delivery-pipe in the bottom of the cistern. The level of the water in the cistern, which is determined by the ball-cock by which water is supplied, is below the bend of the syphon, and in the normal position of the parts the apparatus is inoperative. When, however, the cord or chain is pulled, the flap is suddenly lifted and the water above it raised to the bend of the syphon, which is thereby set in action, the water of the cistern being delivered by the descending leg of the syphon to the place to be flushed.

14,043.—SCREW-DRIVERS: *W. W. Horn.*—The object of this invention is to produce rotary motion in a screw-driver by means of helical grooves in the spindle, in connexion with a handle and two pairs of jaws having inclined projections adapted to enter the said grooves, one pair being inclined in one direction, and the other pair in the opposite direction, to rotate the spindle in corresponding directions, at the will of the operator, to either drive or draw a screw by substantially the same operation.

4,939.—FIREPLACES: *G. Middleton and R. Davison.*—This specification refers to a new or improved heating or radiating appliance for use in connexion with domestic fireplaces. It is well known that a large proportion of the heat evolved from the fuel in ordinary fireplaces is wasted, and the object of this invention is to concentrate and distribute the heat into the room, and thus economise fuel. For this purpose the inventors make use of a hollow receptacle, constructed by preference of some good conductor of heat, and in order to afford access to the interior of the receptacle its walls are pierced with holes. The gases evolved from the burning fuel are in this manner attracted to the receptacle, and as the latter is heated in the fire to a red or white heat the gases are burnt therein, thus effecting in a concentrated space an intense heat. It is stated that such an appliance placed in the grate of an ordinary fireplace has the effect of increasing the temperature of a room considerably above the temperature obtained from fuel burnt in grates of the ordinary description, while, at the same time, economy in fuel accrues.

9,293.—CHIMNEY-POTS: *T. Brown.*—This inventor claims to have effected an improvement in chimney-pots, consisting in the pots being fitted with hinged flaps which deflect downward currents outwards from the chimney-pots through orifices in their sides, the flaps being so constructed and arranged that when the chimney-pots are being swept the upward passage of the sweeping-brushes causes the flaps to be thrown back into such a position as not to obstruct the downward passage of the brushes, and that when the brushes are drawn down past the flaps they act on them so as to restore them to their normal position.

NEW APPLICATIONS FOR LETTERS PATENT.

July 18.—13,108, J. Anderson, Automatic Door-bolts.

July 19.—13,175, S. Hill, Window-fastenings.—13,177, J. Collins, Cupboard-turns and Lock Furniture.—13,182, P. Wilson, Automatic Drip-flush and Stop-tap.—13,206, J. Drawbridge, Road-paving. — 13,220, H. Leigh, Enamelled Bricks.—13,232, C. Baumgartel, Water-closet Basins.—13,238, G. Strawson, Attaching Glass to Greenhouses, Roofs, and other Glazed Surfaces. — 13,244, E. Turner, Self-flushing or Sewer Drains.—13,245, E. Turner, House or Sewer Drains.

July 20.—13,251, J. Adair, Bakers' Ovens.—13,268, J. Child, Drain-pipes.—13,288, H. Hirst, Electroliers and other electric-light fittings.—13,302, W. Lilly, Fixing ornamental or other plates or surfaces of glass, porcelain, or the like material to ceiling-walls, &c.

July 21.—13,315, F. Perry, Water-waste Preventing Cistern and Lever-tap or Stop-cock.—13,330, F. Davis, Attaching Knobs and Handles to their spindles.—13,357, W. Downs, Stoves.

July 22.—13,388, T. Knowles, Outlets of sinks, slop-stones, lavatories, baths and troughs.—13,392, J. and T. Clark, Window-sash fastener.—13,416, H. Doulton and R. Meldrum, Glazing pottery.—13,421, H. Bueley, Spirit-levels, &c.

July 23.—13,435, J. & W. Shedlock, Nails.—13,442, J. Halley, Fasteners for Window-sashes, &c.—13,447, A. Hoyle, Automatic Disinfector for Water.

closets.—13,449, L. Wilson, Production of Designs, Devices, &c., in Wood, Tiles, Panels, and similar articles, to be used on Floors, Stairs, Walls, &c.—13,462, W. & E. Freeman, Window-sashes.—13,478, J. Jameson, Hanging Window-sashes.—13,479, J. Jameson, Fasteners for Windows, Casements, and Shutters.—13,489, J. Robinson, Swinging Door Springs, and parts connected therewith.

PROVISIONAL SPECIFICATIONS ACCEPTED.

9,782, H. Martin, Tools for forming recesses in bricks or other articles made of clay, &c. 9,903, H. Milham and T. Broadbent, Bolts for Doors, &c.—10,547, A. Wilcockson, Water-closets.—11,447, H. Wood, Fire-grates.—11,576, T. Duggan, Disinfecting Apparatus for Water-closets.—12,071, W. Pick, Water Mains and Water Service-pipes.—12,426, H. Cutler, Folding Ladders.—12,502, C. Parkin, Draught Excluder for Windows, Doors, &c.—12,505, J. Bouillon Fils-Ainé, Tonguing, Grooving, Mortising, Tenoning, and otherwise shaping Wood, and a Setting Instrument employed in connexion therewith.—12,509, J. Hull and others, Weather Strips for Doors, &c.—12,512, J. Salkeld, Construction of Fire-proof Floors, &c.—12,843, A. Varah, Attaching and Adjusting Door-knobs.

COMPLETE SPECIFICATIONS ACCEPTED.

(Open to Opposition for Two Months.)

13,357, G. Leighton, "Anti-frost" Supply Cistern.—11,193, P. Bright, Water-closet.—11,357, P. Klinka, Flat Reliefs for Wall-papers, &c.—11,407, C. Hall, Enamelled Bricks and Tiles.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

JULY 16.—By *Messrs. Spelman* (at Norwich): "The Upgate Farm," near Norwich, 44a. 0r. 36p., f. and c., 1,425*l.*; freehold house and shop, Stalham, 220*l.*; freehold house, r. 7*l.* 15s., 140*l.*; an enclosure of freehold land, 3a. 1r. 8p., 80*l.*; copyhold house and market garden land, 6a. 2., 350*l.*

JULY 21.—By *Messrs. Cobb* (at Maidstone): "Munk's Farm," near Wrotham Station, 19a. 1r. 3p., and fruit land, 1a. 3r. 5p., freehold, 1,050*l.*—By *Humbert, Son, & Flint* (on the Estate): Twelve plots of f. land, Bushey-grove, Watford, 1,739*l.*

JULY 25.—By *C. R. Cross*: 1 and 2, Sinclair Mansions, Kensington, f., including mortgage, 25,000*l.*—By *W. Levens*: "Aldersmead Villa," Beckenham, u.t. 82 yrs., g.r. 6*l.*, r. 45*l.*, 420*l.*—By *Eastman Bros.*: 12, Sunderland-rd., Forest Hill, u.t. 86 yrs., g.r. 8*l.*, r. 33*l.*, 400*l.*—By *P. Hodson*: 50, Amberley-rd., Paddington, u.t. 70 yrs., g.r. 7*l.*, r. 40*l.*, 440*l.*—By *Ball, Norris, & Hadley*: No. 53, Fleet-st., f., area 1,265 ft., 10,600*l.*—By *G. W. Potter*: 149, 151, and 153, Balls Pond-rd., Islington, u.t. 11 yrs., g.r. 16*l.* 1s., 405*l.*—By *R. Tidey & Sons*: 78, Denbigh-st., Pimlico, u.t. 35 yrs., g.r. 8*l.*, 455*l.*; 192, Barnet-grove, Bethnal Green, u.t. 33 yrs., g.r. 8*l.* 10s., r. 42*l.*, 200*l.*; 43, Balmes-rd., Kingsland, u.t. 38 yrs., g.r. 4*l.*, r. 34*l.*, 310*l.* By *E. Owers*: f.g.r. of 8*l.*, Birkbeck-rd., Acton, reversion in 88 yrs., 205*l.*; 15, College-rd., Kensal Green, u.t. 91 yrs., g.r. 5*l.*, r. 31. 4s., 210*l.*—By *Debenham, Tewson, & Co.* (at Great Marlow): Two plots of freehold land, Marlow, 750*l.*—By *Messrs. Spelman* (at Norwich): "Heathfield House," Ipswich-rd., Norwich, u.t. 43 yrs., g.r. 18*l.*, r. 110*l.*, 2,000*l.*; 22, Park-lane, f., r. 42*l.*, 670*l.*; two plots of f. land, Thorpe, near Norwich, 0a. 3r. 22p., 1,030*l.*; "The Elms," with stabling and grounds, f., 1,300*l.*

JULY 26.—By *A. Richards* (at Tottenham): 1 to 4, Madras-cottages, Southgate, u.t. 72 yrs., g.r. 8*l.*, 500*l.*; 29 to 35, Nelson-rd., Tottenham, u.t. 88 yrs., g.r. 28*l.*, 630*l.*—By *Farebrother, Ellis, & Co.* (at Stoke-upon-Trent): "Dieulacresse Abbey," Leek, and 286a. 3r. 33p., freehold, 11,000*l.*; "Upper Foker Farm," 77a. 2r. 0p., freehold, r. 130*l.*, 3,200*l.*; "Abbey Cottage," with grounds, 25*l.*, 670*l.*—By *E. Simpson*: 142, 144, 150, and 152, Rolt-st., Deptford, u.t. 75 yrs., g.r. 16*l.* 16s., 800*l.*; 146 and 148, Rolt-st., u.t. 75 yrs., g.r. 4*l.* 4s., 440*l.*; 90, Bentham-rd., Hackney, u.t. 58 yrs., g.r. 4*l.*, 225*l.*—By *Dolman & Pearce*: No. 45, Haveratock-hill, u.t. 38 yrs., g.r. 11*l.* 5s., r. 80*l.*, 580*l.*—By *H. J. Bromley*: 14, Clifton-rd., St. John's, S.E., u.t. 73 yrs., g.r. 7*l.* 15s., 530*l.*—By *Messrs. Mellersh*: Three freehold cottages, Shackleford, Surrey, 370*l.*—By *Rushworth & Stevens*: 48, Mortimer-st., Portland Estate, u.t. 12 yrs., g.r. 50*l.*, r. 110*l.*, 430*l.*—By *Ventom, Bull, & Cooper*: 27, Thomas-st., Whitechapel, part f. and part l., r. 119*l.* 12s., 1,250*l.*; 13, White's-row, f., area 4,000 ft., r. 60*l.*, 1,250*l.*—By *Driver & Co.*: "World's End Farm," Pebmarsh, Essex, 80a. 2r. 31p., f., 1,325*l.*; three cottages and 5a. 3r. 5p., f., 400*l.*—By *Bean, Burnett, & Co.*, "The Briary," Maxwell-rd., Northwood, f., r. 80*l.*, 1,200*l.*—By *Debenham, Tewson, & Co.*: 49, Addison-rd., Kensington, u.t. 63 yrs., g.r. 10*l.*, 2,225*l.*

JULY 27.—By *Turner, Rudge, & Turner*: Freehold land, 21a. 3r. 10p., East Grinstead, 5,000*l.*; a plot of freehold land, 1a. 1r. 20p., 800*l.*; 9, Middle-row, f., r. 15*l.*, 260*l.*—By *Sales & Wiltshire*: 111 and 113, Brightfield-rd., Lee, u.t. 92 yrs., g.r. 10*l.*, 460*l.*—By *E. Christian*: 181, Salmon's-lane, Limehouse, f., r. 32*l.*, 660*l.*—By *Dann & Lucas*: an enclosure of land, Bexley Heath, 3a. 2r. 29p., f., 530*l.*—By *A. Richards*: 76 and 78, Upper Fore-st., Edmonton, u.t. 12 yrs., g.r. 24*l.*, 200*l.*; 80 and 82, Upper Fore-st., f., r. 50*l.*, 900*l.*; a plot of f. land, Upper Fore-st., 24*l.*—By *A. Gray*: 7 and 9, Hungerford-st., St. George's-in-the-East, f., 250*l.*—By *Furber, Price, & Furber*: 41, Neal-st., Shaftesbury-av., f., area 2,940 ft., r. 220*l.*, 4,400*l.*; 31, Great Queen-st., and 13 and 15, Parker-st., Lincoln's Inn-fields, f., r. 180*l.*, 3,620*l.*—By *Rogers, Chapman, & Co.*: 24, Cambridge-st., Pimlico, u.t. 45 yrs., g.r. 7*l.*, r. 55*l.*, 550*l.*; 18, Claverton-st., u.t. 42 yrs., g.r., 10*l.*, 565*l.*; 158 and 160, Tachbrook-st., u.t., 38 yrs., g.r., 16*l.*, 850*l.*—By *C. N. Phillips*: 25, 27, and 29, Albert-rd., Stratford, f., 765*l.*—By *Protheroe & Morris*: 28, Trevor-sq., Knightsbridge, u.t. 25 yrs., g.r. 8*l.*, 470*l.*; 2, Buckingham Villas, Woodford, f.r. 22*l.*, 300*l.*

JULY 28.—By *Field & Sons*: No. 543, Holloway-rd., u.t. 12 yrs., g.r. 7*l.*, r. 38*l.*, 160*l.*—By *Holcombe & Betts*: 105, London-rd., Clapton, f., 380*l.*; 68, Prince's-sq., Hyde-pk., u.t. 60 yrs., g.r. 21*l.*, 1,000*l.*—By *C. & H. White*: 7, Hayles-ter., Southwark, u.t. 21 yrs., g.r. 5*l.*, 130*l.*; 124, 128, and 130, Hill-st., Walworth, u.t. 7 yrs., g.r. 11*l.* 10s., 110*l.*; 15 and 17, Chapel-st., Brixton, u.t. 5 yrs., g.r. 9*l.* 15s. 9d. 114*l.*; 45 and 47, Baker-st., u.t. 9 yrs., g.r. 4*l.* 10s., 131*l.*—By *W. & F. Houghton*: "The Limes," Hoe-st., Walthamstow, f., 520*l.*; "Ash Cottage," Brown's-rd., f., 200*l.*; a plot of f. land, Tower Hamlets-rd., 180*l.*—By *C. C. & T. Moore*: 1, Ferry-villas, Walthamstow, f., r. 24*l.*, 340*l.*—By *A. C. Lowry*: 36, 38, and 40, East-rd., Plaistow, f., 720*l.*; 91 and 93, Park-rd., f., 960*l.*; 1, Baron-rd., Barking-rd., u.t. 93 yrs, g.r. 5*l.*, r. 30*l.*, 210*l.*—By *Newbon & Co.*: 41, Drayton-pk., Highbury, f., 630*l.*; 85, Roman-rd., Holloway, u.t. 69 yrs., g.r. 6*l.* 10s., r. 32*l.*, 220*l.*; 3, St. James's-rd., u.t. 69 yrs., g.r. 6*l.* 6s., r. 60*l.*, 540*l.*; 13 and 15, High-st., Stoke Newington, u.t. 8 yrs., g.r. 30*l.*, r. 140*l.*, 420*l.*—By *B. Brown*: 40 to 46 (even), Ellesmere-st., Bromley-by-Bow, u.t. 70 yrs., g.r. 10*l.*, 480*l.*; 219 and 221, Brunswick-rd., u.t. 70 yrs., g.r., 8*l.*, 470*l.*—By *Stimson & Sons*: F.g.r. of 80*l.*, Weston-st., Norwood, reversion in 34 yrs., 3,050*l.*; f.g.r. of 15*l.*, Hinton-rd., Brixton, reversion in 73 yrs., 380*l.*; f.g.r.'s of 120*l.* 18s., Wigmore-rd., ditto in 73 yrs., 3,265*l.*; f.g.r.'s of 53*l.* 10s., Gonsalva-rd., Wandsworth, ditto in 86 yrs., 1,175*l.*; f.g.r. of 65*l.*, Gayford-rd., Shepherd's Bush, ditto in 92 yrs., 1,630*l.*; f.g.r. of 18*l.* 10s., College-st., Putney, ditto in 83 yrs., 460*l.*; f.g.r.'s of 48*l.*, Lower-rd., Plaistow, ditto in 86 yrs., 940*l.*; f.g.r.'s of 12*l.*, Whitwell-rd., ditto in 86 yrs., 275*l.*; f.g.r. of 24*l.*, George-st., ditto in 86 yrs., 440*l.*; 8 to 22 even, Ambrose-st., Bermondsey, u.t. 43 yrs., g.r. 27*l.* 10s., r. 234*l.*, 1,660*l.*; 59, Lowden-rd., Brixton, u.t. 73 yrs., g.r. 4*l.* 10s., 195*l.*—By *Wood & Kirby*: 29, 30, and 31, Beaconsfield-ter., Wimbledon, u.t. 88 yrs., g.r. 15*l.*, 260*l.*; a plot of freehold building land, Garfield-rd., 10*l.*—By *P. D. Tuckett* (at Banbury): "The Manor House," near Banbury, and 306a. 1r. 29p., f., r. 370*l.*, 6,100*l.*; an enclosure of meadow land, 5a. 0r. 2p., freehold, 100*l.*; an enclosure of pasture land, 14a. 0r. 16p., freehold, 980*l.*; two enclosures of freehold meadow land, 19a 2r. 9p., 800*l.*

JULY 29.—By *Jones, Lang, & Co.*: F.g.r. of 55*l.*, Bartholomew-close, City, reversion in 67 yrs., 17,600*l.*; f.g.r. of 25*l.*, Lombard-st., reversion in 47 yrs., 10,260*l.*—By *A. Savill & Son*: Two plots of freehold land, Capworth-st., Leyton, 1,440*l.*; "Suffolk House," with stabling, freehold, r. 50*l.*, 1,140*l.*—By *F. E. Eiloart*: 35 to 38, Lyon-st., Islington, u.t. 52 yrs., g.r. 20*l.*, r. 136*l.*, 1,250*l.*; 1 to 17 (odd), Pembroke-st., u.t. 57 yrs., g.r. 37*l.* 16s., r. 270*l.*, 2,440*l.*—By *G. A. Wilkinson & Son*: f.g.r. of 40*l.*, Ladbroke-sq., Notting Hill, u.t. 47 yrs., g.r. 7*l.*, 600*l.*; f.g.r. of 40*l.*, Ladbroke-sq., u.t. 47 yrs., g.r. 7*l.*, 600*l.*; 30, St. Mary Abbotts-ter., Kensington, u.t. 12 yrs., g.r. 13*l.*, r. 110*l.*, 565*l.*—By *Vaughan & Co.*: 4, Edward-st., Hampstead-road, u.t. 77 yrs., g.r. 10*l.*, 900*l.*; 26 and 30, St. George's-rd., Primrose Hill, u.t. 71 yrs., g.r. 10*l.*, 102*l.* 10s., 1,070*l.*—By *C. P. Whiteley*: 26, Northcote-rd., Clapham, and 22 and 25, Cairn's-rd., f., r. 115*l.*, 1,980*l.*; 12, Endsleigh-st., Tavistock-sq., u.t. 31 yrs., g.r. 5*l.*, 700*l.*; 302, Southampton-st., Camberwell, u.t. 58 yrs., g.r. 10*l.* 10s., 565*l.*; f.g.r. of 25*l.* 5s., Ordnance-rd., Woolwich, reversion in 88 yrs., 570*l.*; f.g.r. of 21*l.* 6s., Riverdale-rd., Plumstead, reversion in 88 yrs., 490*l.*—By *Herring, Son, & Daw*: F.g.r. of 17*l.* 10s., Upper Tulse Hill, reversion in 47 yrs., 455*l.*; f.g.r. of 34*l.*, reversion in 47 yrs., 910*l.*; 57, Fernlea-rd, Balham, u.t. 64 yrs., g.r. 6*l.* 10s., r. 30*l.*, 275*l.*—By *A. H. Turner & Co.*: The f. residence, "The Wilderness," Lingfield, 320*l.*; 51, St. Margaret's-avenue, f., 500*l.*: 1 to 4, Manor-rd., Leyton, f., 810*l.*—By *Baker & Sons*: 1, 2, & 3, Fitzjohn's-esplanade, Hampstead, u.t. 98 yrs., g.r. 90*l.*, r. 480*l.*, 6,100*l.*; 4 to 8, ditto, u.t. 98 yrs., g.r. 200*l.*, r. 1,000*l.*, 12,790*l.*; 9 and 10, ditto, u.t. 98 yrs, g.r. 80*l.*, r. 400*l.*, 5,120*l.*; 11, ditto, u.t. 98 yrs., g.r. 40*l.*, r. 200*l.*, 2,520*l.*; 28, 30, 32, 34, and 38, Ingrave-st., Battersea, u.t. 57 yrs., g.r. 25*l.*, r. 151*l.*, 900*l.*; 92, Lavender-rd., u.t. 46 yrs., g.r. 3*l.* 12s., r. 26*l.*, 210*l.*; 48 and 50, Falcon-rd., sold before auction; 1 to 10, Mary-pl., Wapping, u.t. 80 yrs., g.r. 50*l.*, 175*l.*—By *George Brinsley*: 5, Crawford-st., Camberwell, u.t. 16 yrs., g.r. 10*l.*, r. 55*l.*, 205*l.*; 328, Camberwell New-rd., u.t. 16 yrs., g.r. 8*l.*, r. 62*l.* 10s., 240*l.*; a profit rental of 162*l.* a year, Sydenham, u.t. 21 yrs., 1,620*l.*; 1 and 2, Cambridge-rd., Malden, u.t. 58 yrs., g.r. 7*l.* 10s., r. 44*l.*, 275*l.*; 4, Albert Villas, u.t. 78 yrs., g.r. 4*l.* 4s., r. 24*l.*, 145*l.*

[*Contractions used in these lists.*—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold: l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard, &c.]

PRICES CURRENT OF MATERIALS.

TIMBER.		
Greenheart, B.G. ton	9/8/0	0.0 0
Teak, E.I... load	9/10/6	15/0/0
Sequoia, U.S.ft.cu.	2/3	3/0
Ash, Canada load	2/10/0	4/0/0
Birch, do.	3/5/0	4/10/0
Elm, do.	3/10/0	4/15/0
Fir, Dantzic, &c.	1/10/0	2/10/0
Oak, do.	3/0/0	5/5/0
Canada.....	5/10/0	7/0/0
Pine, Canada red	2/10/0	3/10/0
Do, yellow	2/10/0	5/0/0
Lath, D'ntzic,fath	5/0/0	6/0/0
St. Petersburg	5/0/0	7/0/0
Deals, Finland 2nd & 1st std	7/10/0	9.10 0
Do, 4th & 3rd..	7/0/0	8/0/0
Do, Riga	6/10/0	8/0/0
St. Petersburg, 1st yellow ..	10/10/0	14/10/0
Do. 2nd yellow	8/0/0	9/10/0
Do. white	7/10/0	10/0/0
Swedish	7/0/0	15/10/0
White Sea	8/0/0	17/0/0
Canada, Pine 1st	20/0/0	26/0/0
Do. do. 2nd....	14/10/0	16/0/0
Do. do. 3rd, &c.	8/0/0	10/0/0
Do. Spruce. 1st	8/10/0	11/0/0
Do. do. 3rd & 2nd.....	6/15/0	8/0/0
New Brunswick	7/0/0	7/10/0
Battens, all kinds	3/10/0	16/10/0
Flooring Boards, sq., 1 in. prep. 1st	0/8/0	0/13.6
Do. 2nd.....	0/7/0	0/10/6
Other qualities	0/3/6	0/8/0
Cedar, Cuba ..ft.	/3½	/4½
Honduras, &c.	/3½	/4
Mahogany, Cuba.	/4½	/6½
St. Domingo, cargo av	/4½	2/0
Mexican do. do	/4	/5
Tobasco do. do	/5½	/7
Honduras do..	/5½	/6½
Box, Turkey ton	4/0/0	12/0/0
Rose, Rio.....	10/0/0	20/0/0
Bahia	8/0/0	18/0/0
Satin, St. Domingo ....ft.	0/0/3	0/1/3

TIMBER (*continued*).		
Satin, Porto Rico	0/0/3	0/1/6
Walnut, Italian..	0/0/3½	0/0/7
METALS.		
IRON—Pig, in Scotland .....ton	2/1/10	0.0.0
Bar, Welsh, in London.....	5/17/6	6/0/0
Do. do. at works in Wales	5/7/6	5/10/0
Do. Staffordshire, in London	5/5/0	6/15/0
COPPER—British, cake and ingot	47/15/0	48.5 0
Best selected ..	48/15/0	49/5/0
Sheets, strong..	56/10/0	0/0/0
Chili, bars	44/15/0	45/2 6
YELLOW METAL lb.	0/0/4½	0/0/5½
LEAD—Pig, Spanish ....ton	10/7/6	10/10/0
English, com. brands	10/12 6	10/15/0
Sheet, English, 3 lbs. per sq. ft. and upwards ..	12/0/0	0/0/0
Pipe	12/10/0	0/0/0
ZINC—English sheet .....ton	25/15/0	26/0/0
Vieille Montagne.....	26/5/0	0/0/0
TIN—Straits	97/0/0	97/10/0
Australian	97/10/0	98 0 0
English Ingots.	97/10/0	98/0/0
OILS.		
Linseed .....ton	18/5/0	18/7/6
Cocoanut, Cochin	24/10/0	24/15/0
Do. Ceylon	22/0/0	0 0 0
Palm, Lagos	22/5/0	22/10/0
Rapeseed, English pale	24/10/0	25/0/0
Do. brown	23/0/0	0/0/0
Cottonseed ref...	19/7/6	0/0/0
Oleine	21/10/0	22/10/0
Lubricating, U.S.	4/0/0	5/0/0
Do. refined	5/10/0	12/0/0
TAR—Stockholm barrel	0/19/0	0/0/0
Archangel	0/12/0	0/0/0

TENDERS.

[Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than* 12 *noon on Thursdays.*]

BIRMINGHAM.—Accepted for the erection of cottage homes, at Northfield, for the Kings Norton Board of Guardians. Mr. F. B. Osborne, architect:—

H. Grant, Selby Oak £3,477 0 0

BIRMINGHAM.—Accepted for the erection of two villa residences in the Thornhill-road, Handsworth, for Mr. A. Jones. Mr. Oliver Floyd, architect:—

H. Grant, Selby Oak £697 0 0

DARENTH (Kent).—For painting work at the School for Imbeciles, Darenth, near Dartford, Kent, for the Metropolitan Asylums Board. Messrs. A. & C. Harston, Architects, 15, Leadenhall-street, E.C.:—

E. Proctor.....	£763	M. Batchelor	£576
Akers & Co.....	629	W. F. Hadlow, Dover*	547
W. & E. Mills.....	625		

* Accepted

FINCHAMPSTEAD (Berks).—For additions to house and stabling at Finchampstead, Berks. Messrs. Peak & Lunn, architects, Guildford. Quantities supplied:—

Kingerlee	£1,548	Bottrill & Son, Reading*..	£1,396
Mitchell Bros.	1,521	Hughes	1,350

* Accepted.

FULHAM.—For erecting four hospital huts and sundry external works, laying mains, &c., at the Western Hospital, Seagrave-road, Fulham, for the Metropolitan Asylums Board. Messrs. A. and C. Harston, Architects, 15, Leadenhall-street, E.C.:—

C. Wall	£3,805	Johnson & Co.	£3,470
Garlick & Horton, Ltd. ..	3,723	Leslie & Co., Kensington-square, W. (accepted)....	3,042
Lascelles & Co.	3,659		

HORRABRIDGE (Devon).—For erecting the new Church of St. John the Baptist, Horrabridge, Devon. Mr. George H. Fellowes Prynne, architect, London. Quantities supplied by Mr. R. Henry Hale, F.S.I., London:—

	Original Tenders.	Revised Tenders.	Boundary Wall.
W. Trevena	£4,373	£4,030	£227
Reed & Blight.....	3,722	3,468	724
John Berry	3,407	3,022	367
George Shellabeer.....	3,250	—	—
Lapthorne & Goad.....	3,102	—	—
Ambrose Andrews.....	2,800	2,600	480
W. H. Higman	2,693	2,468	339
P. Blowey.....	2,589	2,350	298
H. B. Fuge	2,530	*2,270	375

* Accepted.

JERSEY.—Accepted for warming the parish church, Jersey:—

John Grundy, London..... £100 0 0

LONDON.—For repairs and painting to the Chelsea Infirmary, for the Guardians of the Poor. Messrs. A. & C. Harston, Architects, 15, Leadenhall-street:—

		Add for certain other works.	Total.
Batchelor	—	—	£1,190 0 0
Hilder & Edge....	£1,040 0 0	£20 0 0	1,060 0 0
Wade	—	—	942 5 0
Stewart & Co.....	—	—	899 7 6
Jenner	850 0 0	39 0 0	889 0 0
Foxley, Kingsstreet, W.	846 0 0*	52 0 0	898 0 0
Architects' estimate	755 0 0	45 0 0	800 0

* Accepted at £846.

LONDON.—For constructing new main drain and manholes at the Western Hospital, Seagrave-road, Fulham, for the Metropolitan Asylums Board. Messrs. A. & C. Harston, Architects, 15, Leadenhall-street, E.C.:—

W. Neale	£321	Leslie & Co., Kensington-square, W. (accepted)	£270
Killingback & Co.	317		

LONDON.—For the re-erection of "Scott's" Restaurant (first portion), 18 and 19, Coventry-street, for Messrs. Sinclairs & Sinclair. Messrs. Treadwell & Martin, architects, 2, Waterloo-place, Pall Mall, S.W. Quantities supplied:—

F. Mark'	£10,479	Bush & Sons.....	£9,327
J. Simpson & Son.....	10,000	Mark Patrick & Son	9,160
E. Lawrence & Sons	9,744	C. F. Kearley	8,983
Whitehead & Co.	9,675		

LONDON.—For repairs and new front to the "Royal Alfred" public-house, 267, Kingsland-road, N., for Messrs. Daniell & Sons' Breweries, Limited, Colchester. Mr. J. W. Start, F.S.I., architect, Cups Chambers, Colchester:—

J. & H. Cocks	£498	B. Smith, 47, Downham-road, Kingsland-road, N.*	£276
R. W. Setchell.....	485		

* Accepted.

LONDON.—For new shop-front and alterations, 170, Victoria-street, S.W., for the Belgravia Hosiery Company. Mr. Alfred Broad, architect, 27, Dingwall-road, Croydon:—

W. H. Lascelles & Co. ..... £376 | E. J. Saunders... ..... £350

LONDON.—For additions to form new billiard-room at Queen's Club, West Kensington, for the Directors. Mr. Alexander Payne, architect, Norfolk House, Victoria Embankment:—

E. Swan.....	£325	Longmire & Co.*	£282
J. Mears.....	325		

* Accepted.

LONDON.—Accepted for the erection of stabling, offices, &c., in Paul-street, E.C., for Messrs. McNamara & Co., Limited. Mr. Percy U. Britton, Assoc. M.Inst.C.E., architect, Bell-lane, Spitalfields:—

Wilkinson Bros., Finsbury-park, N..... £5,679 0 0

PENKRIDGE.—For erecting Curate's house at Penkridge, near Stafford, for the Hon. and Rev. C. J. Littleton. Mr. George Wormall, architect, Stafford:—

		Extra for Pitch-pine.
Gilbert	£1,057 6	£20 0
Adams & Pemburton	1,018 0	—
Muirhead.....	950 0	50 0
Woollams, Stafford*.....	850 0	20 0

* Accepted.

ST. PAUL'S CRAY.—For the erection of eight or sixteen cottages at Paul's Cray Hill Estate, for Mr. Henry Tyrer. Mr. Alexander Payne, architect, Norfolk House, Victoria Embankment:—

	Per Block of Eight.
F. Wood	£1,748 0 0
T. Knight	1,629 0 0
W. Owen	1,600 0 0
H. Somerford & Son	1,575 0 0
J. Otway, Chislehurst (accepted)	1,375 0 0

SHALFORD.—For enlarging schools at Shalford, Surrey, for the Shalford School Board. Messrs. Peak & Lunn, architects, Guildford. Quantities supplied :—

Wells	£680	0 0	R. Pink	£635	0 0
R. Smith	675	0 0	Kingerlee	633	0 0
J. Bottrill & Son	670	0 0	Jackson	615	18 0
Ellis	648	0 0	Higlett & Hammond	609	0 0
Downes	643	0 0	Brown Bros.	598	0 0
Johnson (informal)	645	0 0	Mitchell Bros., Shalford (accepted)	585	0 0
James	641	7 6	Edwards (informal)	579	0 0
Billimore	636	0 0			

STAFFORD.—For the erection of a new workhouse infirmary for the Stafford Board of Guardians. Mr. Geo. Wormal architect, Stafford. Quantities by the architect :—

Whittingham	£4,350	Adams & Pemberton	£3,986
Lowe	4,153	Whittome	3,948
Muirhead	4,150	Espley, Stafford*	3,900
Nevitt	4,080		

* Accepted.

[Architect's estimate, £4,000.]

WINDSOR.—For the construction of new stabling, shoeing-forge, &c., at Thames-street, Windsor, for Messrs. Allnutt & Tennant. Mr. Arthur Vernon, architect, 29, Cockspur-street, London, S.W. :—

Goddard	£1,920	Reavell	£1,707
Bowyer	1,750	Watson	1,659
Kearley	1,743	Hollis (accepted)	1,598

WOKING (Surrey).—For works at Hipley Bridge, Woking, for the Guildford Highway Board. Messrs. Peak & Lunn, architects, Guildford :—

Martin, Wells, & Co.	£400 0	G. A. Franks, Guildford*	£323 10
Higlett & Hammond	329 0	Whitburn	203 10

* Accepted.

WORTLEY.—For the erection of an infectious diseases hospital at the workhouse, Greenside, for the Guardians of the Wortley Union. Mr. G. A. Wilde, architect, Bank-street, Sheffield :—

Lowe & Sons	£5,350 0	Dutton & Evans	£4,387 0
B. Powell & Son	5,247 10	Thos. Nelson, Wadsley Bridge, nr. Sheffield*	4,200 0
Andrew Smith	4,933 0	James Holmes	4,062 0
Samuel Warburton	4,479 0	Frank Byre	4,030 18
Joel Midwood	4,459 0		

* Accepted.

YNYSLAS (Cardiganshire).—For additions and alterations to "Gwynfryn," for the Right Rev. the Lord Bishop of St. David's. Mr. T. H. Morgan, architect, Aberystwyth. Quantities supplied :—

D. Lloyd	£3,246	D. Davies & Son	£2,652
John Davies	3,170	Edw. Davies & Son, Newtown*	2,547
Jenkin Jones	3,039	John Evans	2,225
Evans & Hopkins	2,694		

* Accepted.

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1892.

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17. Llandaff	May 7.	23. Winchester	Oct. 1.
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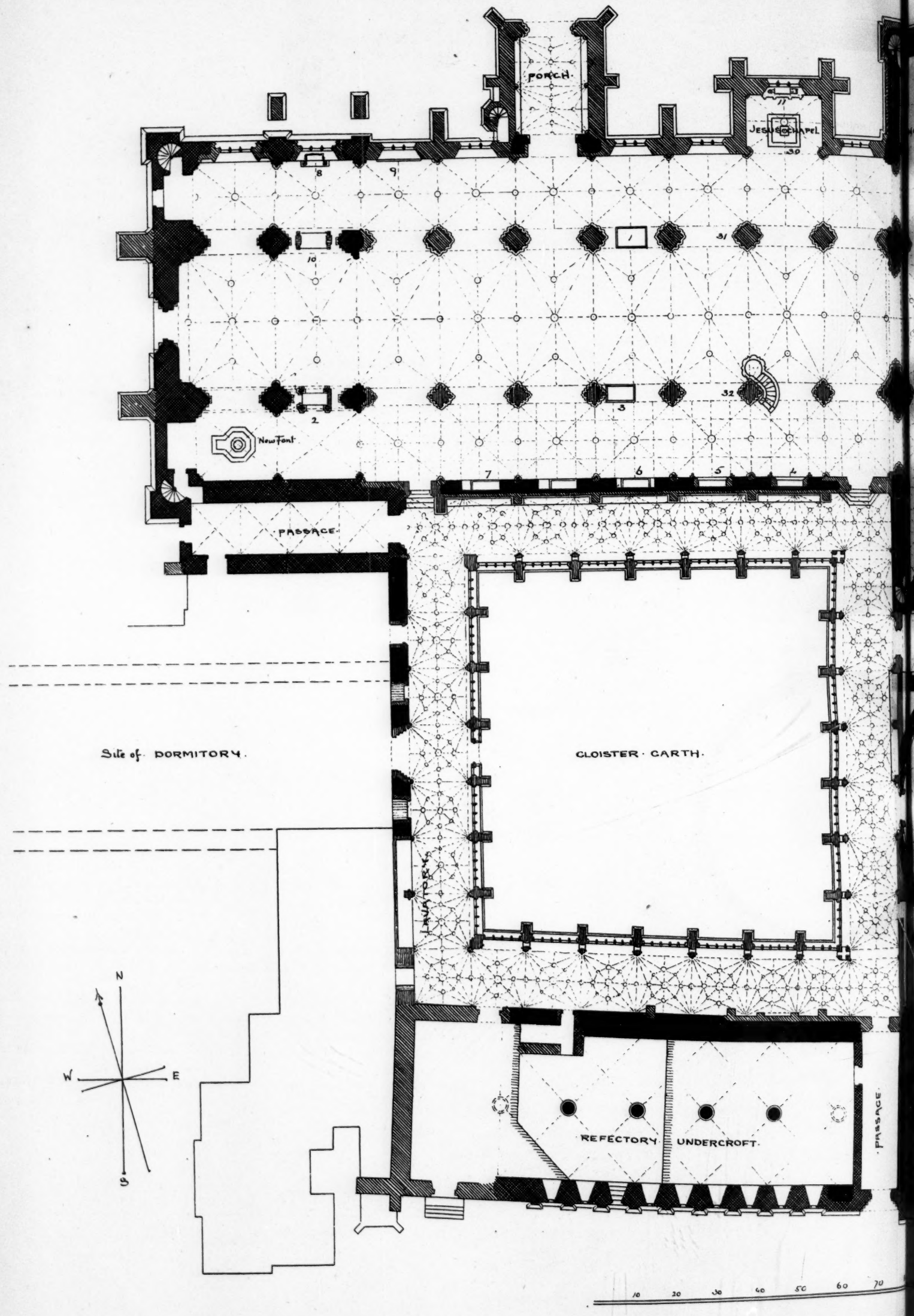
Cathedrals of England and Wales.

No 20. WORCESTER: FROM THE NORTH-WEST.—Drawn by Mr. Beresford Pite, A.R.I.B.A.


PORCH
JESUS CHAPEL
39
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CLOISTER GARTH
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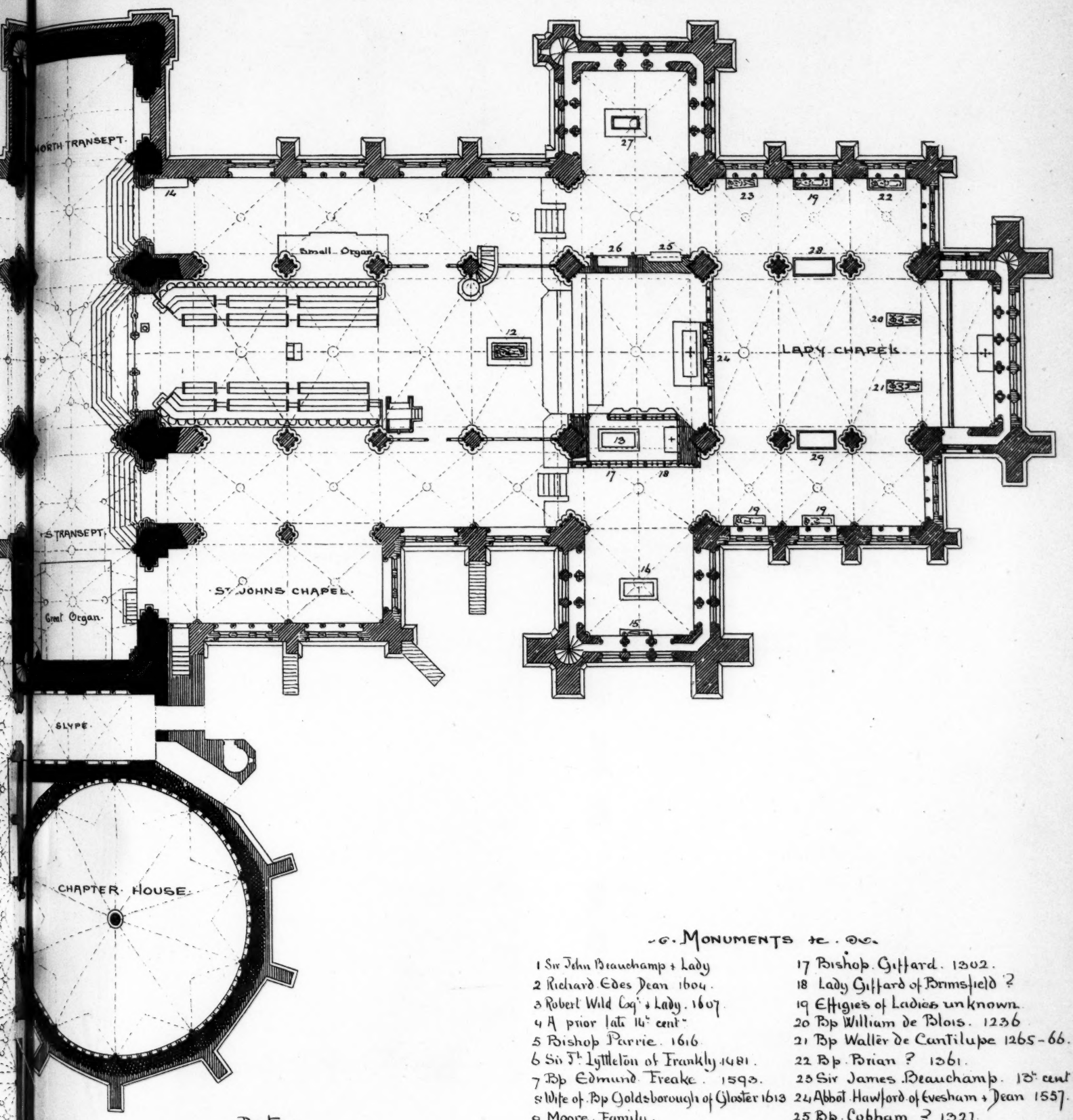


Dates.

- Norman. 1084–1100 Bishop Wulfstan.
- Norman. later.
- Transitional. c 1150. Bp John de Paynham.
- Early English. c 1216 & seq. Bp Silvester.
- Decorated. Bps De Blois. Giffard & Cobham.
- Perpendicular. Bps Lynn & Wakefield &
- Modern. (Giggles

Monuments &c. &c.

1 Sir John Beauchamp & Lady
2 Richard Edes Dean 1604.
3 Robert Wild Esq^r & Lady. 1607.
4 A prior late 14th cent^y
5 Bishop Parrie. 1616.
6 Sir J^n Lyttleton of Frankly 1481.
7 Bp Edmund Freake. 1593.
8 Wife of Bp Goldsborough of Gloster 1613
9 Moore Family.
10 Bp Thornborough 1614.
11 Bp Bullingham. 1576.
12 King John. 1216.
13 Prince Arthur & Chapel. 1502.
14 Bp Maddox. 1759.
15 Sir William Harcourt. 1209.
16 Sir Gryffyth Ryce. 1523.
17 Bishop Giffard. 1302.
18 Lady Giffard of Brimsfield ?
19 Effigies of Ladies unknown.
20 Bp William de Blois. 1236
21 Bp Waller de Cantilupe 1265–66.
22 Bp Brian ? 1361.
23 Sir James Beauchamp. 13th cent^y.
24 Abbot Hawford of Evesham & Dean 1557.
25 Bp Cobham ? 1327.
26 Bp Wulfstan de Bransford ? 1349.
27 Lady Elizabeth Digby. 1820.
28 Baron Lyttleton. 1876.
29 William. Earl of Dudley 1885.
30 Old Font 1770.
31 Site of S^t John Baptist Altar.
32 " Holy Cross Altar.

WORCESTER CATHEDRAL

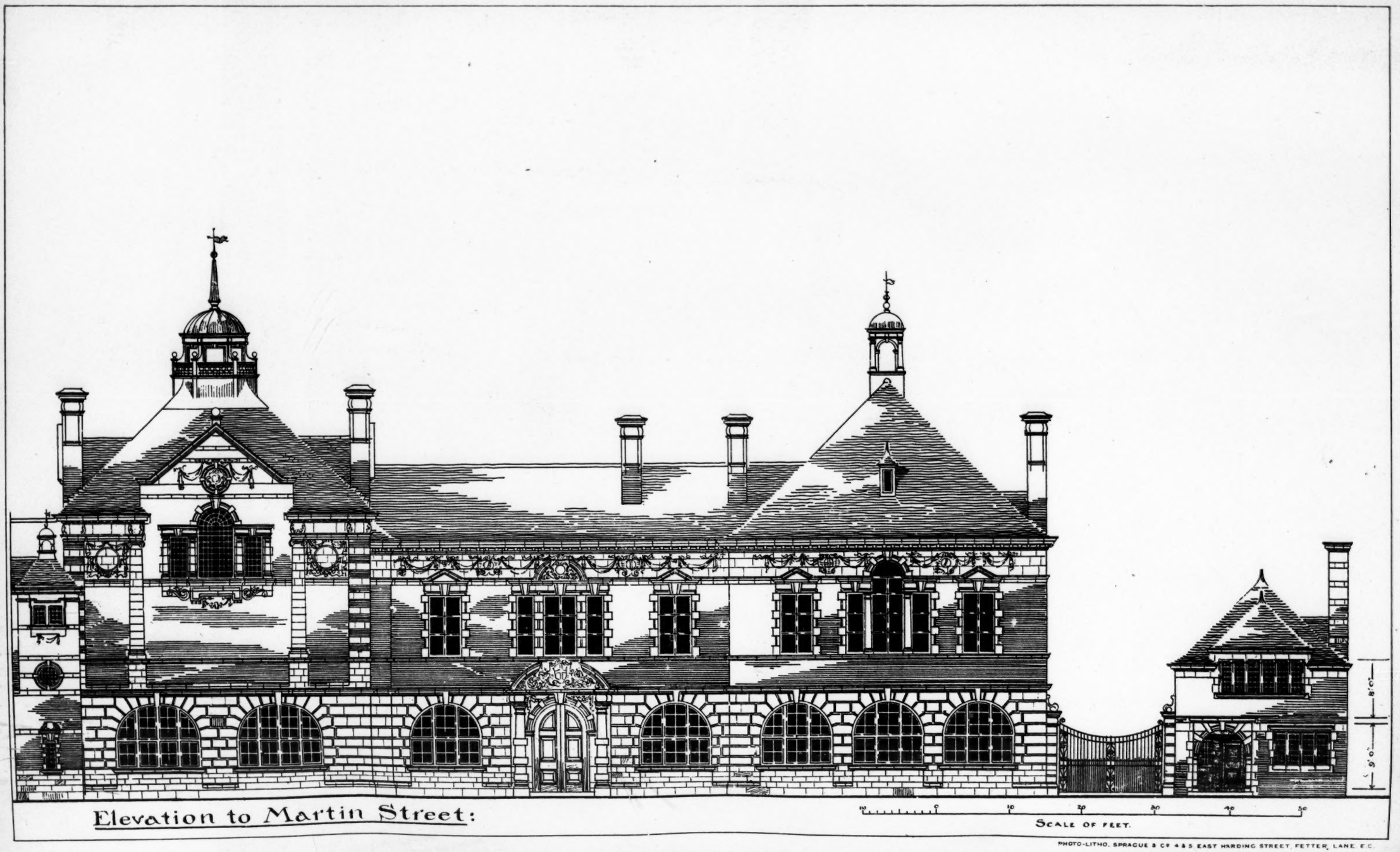
GROUND PLAN.

0 50 100 150 200 Feet.

Scale.

Harold. Brakspear. mens et. delt.

PHOTO-LITHO. SPRAGUE & Co 4 & 5 EAST HARDING STREET, FETTER LANE, E.C.



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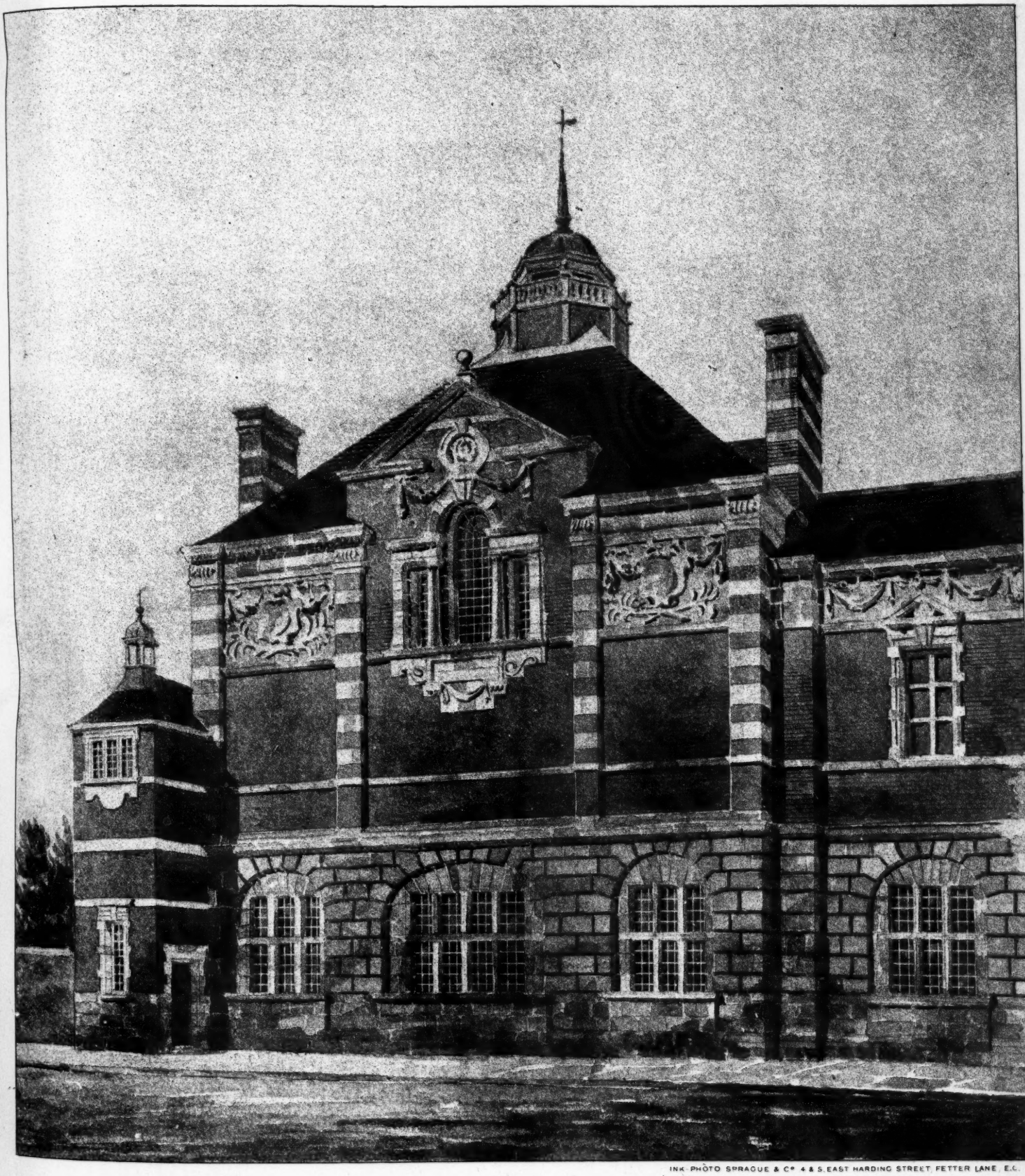
PRINCIPAL ELEVATION.



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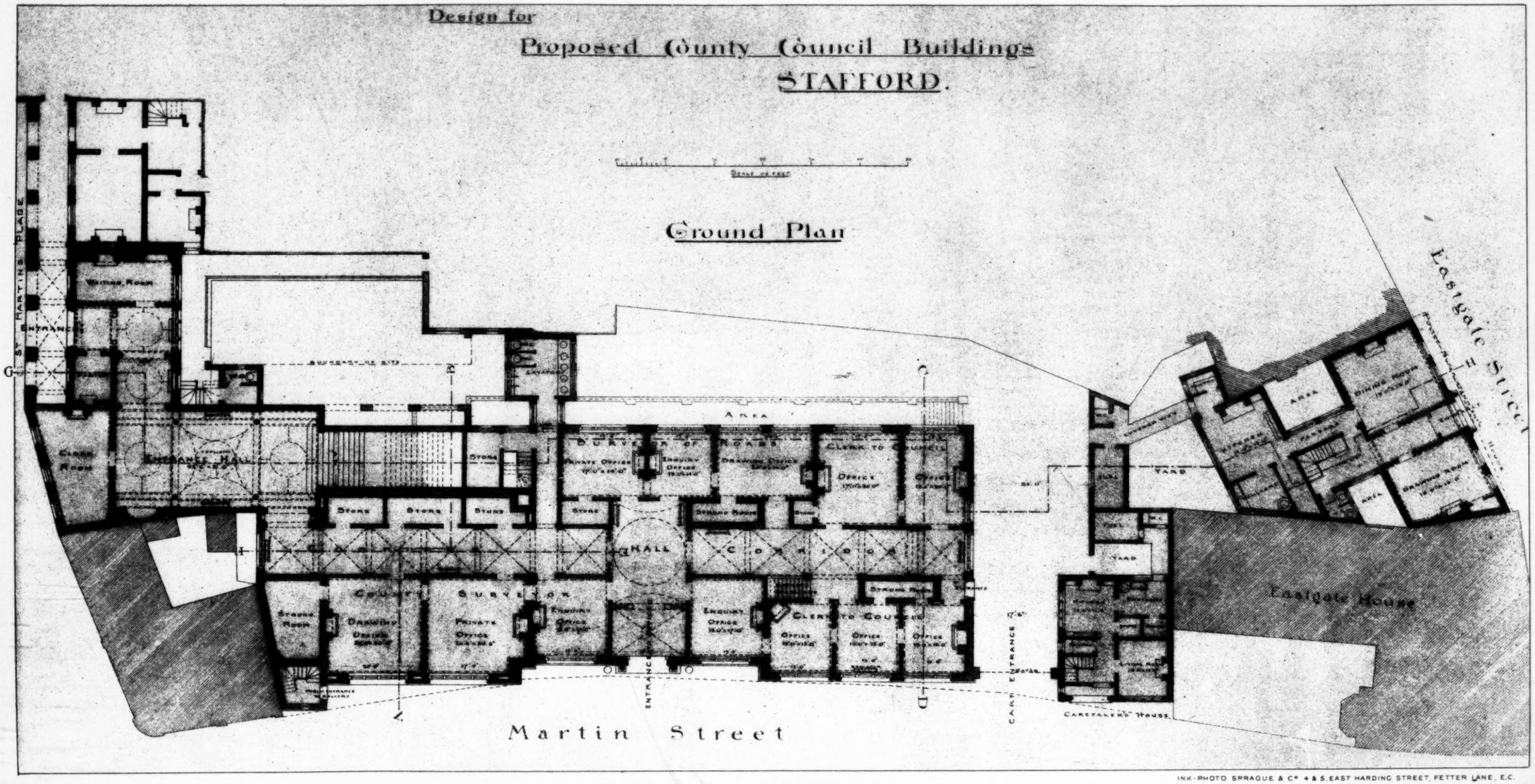
PERSPECTIVE SKETCH (NOT SUBMITTED IN COMPETITION).



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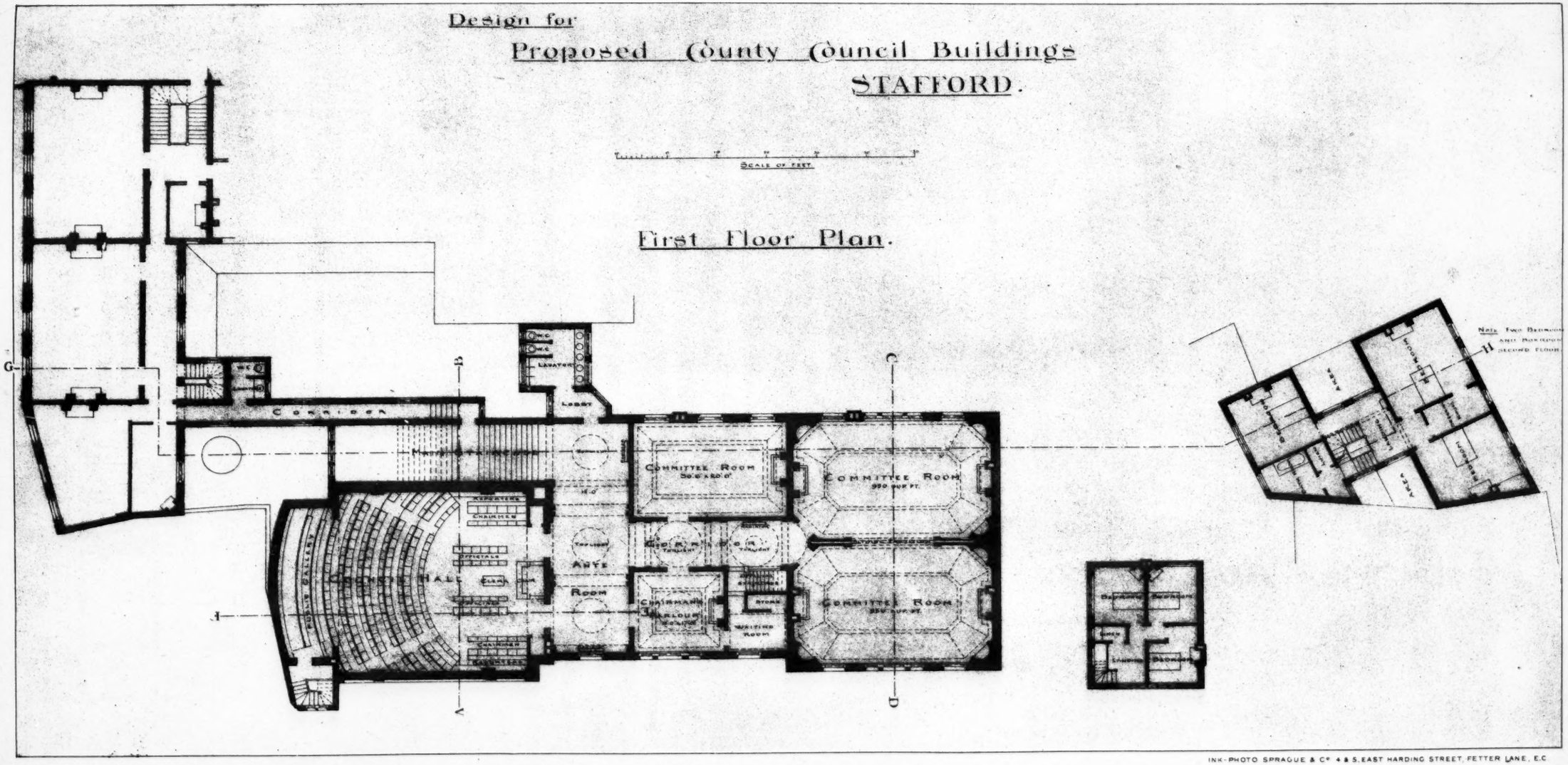
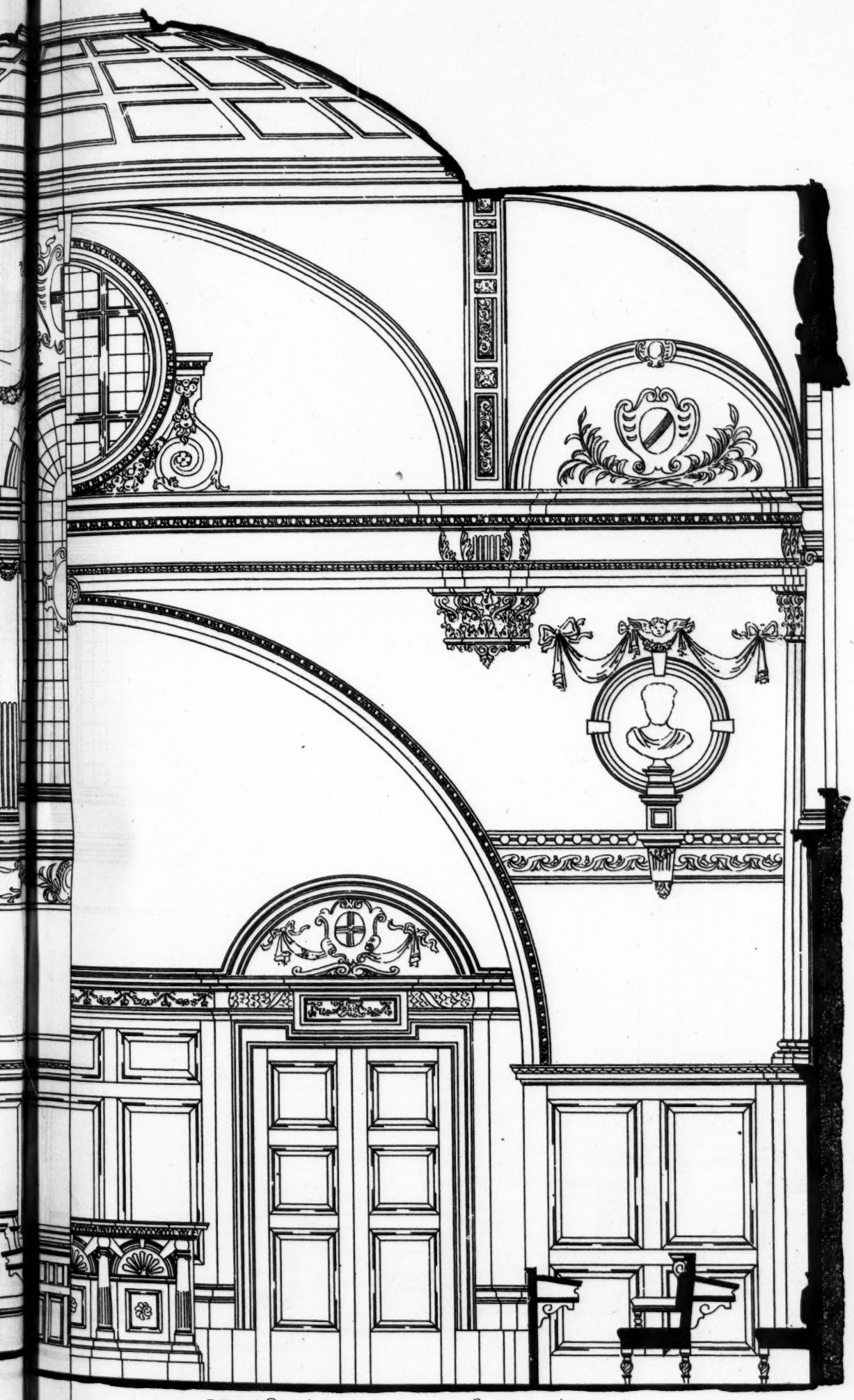
GROUND PLAN.



SELECTED DESIGN FOR STAFFORD COUNTY COUNCIL BUILDINGS.—Mr. H. T. Hare, A.R.I.B.A., Architect.
FIRST FLOOR PLAN.

Half elevation of Side

SELECTED DESIGN FOR STAFFORD COUNTY CO BUILI
DETAILS OF L CH



Half elevation of End

...le of Feet:

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...BUILDINGS.—Mr. H. T. Hare, A.R.I.B.A., Architect.
...L CHAMBER